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THE NEW ZEALAND MEDICAL JOURNAL
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Venous ulcer management in New Zealand: usual care versus guideline recommendations
Andrew Jull, Natalie Walker, Varsha Parag, Peter Molan, Anthony Rodgers; on behalf of the Honey as Adjuvant Leg Ulcer Therapy (HALT) trial collaborators

Participants had their management compared to four treatment recommendations: [1] compression (use high compression); [2] dressing selection (use simple dressings); pentoxifylline (trial of treatment if not tolerant of compression or failure to progress with compression alone) and compression hosiery after healing (remain in hosiery after healing to prevent recurrence). Compression use was consistent with guideline recommendations, although hosiery use after healing could improve. Dressing selection and use of pentoxifylline did not match guideline recommendations. Three of the four guideline recommendations offer opportunities for improving clinical effectiveness, with some potential for cost savings.

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We surveyed New Zealand vascular surgeons' current opinion on this therapy. TNPWT is widely used by New Zealand vascular surgeons, despite many not considering themselves up to date with published evidence. It is most favoured for treating diabetic feet post debridement and for lower limb surgical wounds.

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Screening for diabetes was limited by low uptake of the diagnostic test. Consequently, a similar number of people who were detected from this pilot were likely to remain undiagnosed. Caution is advised against the reliance of cardiovascular risk assessment programmes as the only mechanism to detect people with diabetes and impaired glucose tolerance. The authors support suggestions made by other researchers that further investigations be made into the use of a potentially more convenient test, the HbA1c test, for screening and detecting diabetes.

Management of adult superficial acute abscesses in a tertiary hospital: time for incisive action
Jannah Baker, John Windsor

Patients with acute superficial abscess are usually admitted to hospital where they may wait for days to undergo relatively minor surgery and whilst occupying a hospital bed may prevent elective admission of patients with more significant health problems. In this study of 2475 adult patients with a diagnosis of acute superficial abscess treated at Auckland City Hospital between 1992 and 2007, we found that 59% of these patients could have been treated on a day case basis, but that only 6% had actually been treated as day cases. For the most recent 3-year period, the average cost for each patient admitted with this diagnosis was $4440, whereas the average cost for a day case patient was $1389, indicating a saving of $3501 per patient if a day case service had been available. In 2006 alone there were 202 potential day case admissions with acute superficial abscess, representing an annual saving of $616,302 to the health care budget. Day case management of appropriate patients with acute superficial abscess would result in significant cost savings, decrease hospital bed occupancy and improve patient care.

Honey in the treatment of burns: a systematic review and meta-analysis of its efficacy (review article)
Meme Wijesinghe, Mark Weatherall, Kyle Perrin, Richard Beasley

Honey dressings are a traditional remedy for burns and wounds. It has a number of properties that could potentially aid healing in the treatment of burns. This study reviewed the evidence for the use of honey in the treatment of burns. Available evidence indicates a greater benefit of honey compared with alternative dressing treatments for superficial or partial thickness burns, although the limitations of the study restrict the clinic application of these findings. Further studies are urgently required to determine the role of honey in the management of superficial and partial thickness burns.

Managing venous insufficiency

Manar Khashram, David R Lewis

Although documentation regarding the presentation and treatment of varicose veins has been dated back to the ancient Egyptians in the form of the Ebers papyrus,[1] the evidence on what constitutes the best treatment of venous incompetence and its varied complications is still in evolution. Eighty-five percent of venous ulcers are due to varicose veins.

The historic paucity of good quality evidence is surprising given that venous ulcers affect approximately 1% of the population, New Zealand data suggests that approximately 60% of leg ulcers are recurrent[3] and chronic venous insufficiency reduces quality of life.[2]

Healing venous ulcers can take months or occasionally years, hence the significant burden on health economies. The estimated cost of treating leg ulcers to the National Health Service in the UK during the 1990–1991 period was £400 million.[4] Based on 2002 figures, the average annual cost of treating an ulcer in the United Kingdom varied between 1332 and 2585 euros.[5] Data on the cost of venous ulcers to the health service in New Zealand is lacking.

The best evidence we have suggests that treatment of venous ulcers should fall into two phases: compression applied with layers of bandaging[6] aimed at healing ulcers and surgical management in the form of traditional varicose vein surgery or possibly endoluminal techniques to prevent ulcer recurrence. Compression hosiery also reduces the risk of ulcer recurrence.

A Cochrane review published in 2009 and based on seven randomised controlled trials concluded that compression therapy significantly improved healing rates when compared to no compression.[6] Appropriate compression therapy, in the form of multi-bandaging systems, is the only treatment that has been shown to improve healing of venous ulcers.

Surgery for venous incompetence is both cost effective and beneficial at reducing ulcer recurrence. The role of endoluminal techniques is currently less clear. The effect of surgery and compression on healing and recurrence (ESCHAR) study was a prospective randomised trial that showed venous surgery does not speed up ulcer healing.

After 4 years follow up this study showed that ulcer recurrence rates were less in the group of patients who underwent surgery (27% vs 51%).[7] A systematic review, published in 2008, of 3 other randomised controlled trials confirmed these findings.[8]

Based on a recent health technology assessment, saphenofemoral ligation with stripping of the greater saphenous vein and phlebectomies is both cost-effective and improved quality of life in patients with varicose veins.[9] Some public hospitals in New Zealand currently struggle to offer varicose vein surgery despite the clear benefits.[10]

The role of drug therapy in the management of venous ulcers is still debated by vascular surgeons. When compared with placebo, pentoxifylline seems to improve

venous ulcer healing in patients receiving compression and might have some benefit in patients without compression.[11]

The care of patients with venous ulcers at four centres in New Zealand was compared to national guidelines for the care of people with chronic ulcers. In this issue of the *Journal*, Jull and colleagues showed that 96% of patients were fitted with multi-layer compression, which was concordant with the guidelines.[12] The facilities taking part in this study should be congratulated on this result. The use of dressings was however unsatisfactory. There was significant variation in which dressings were used and non-simple dressings were found to account for a staggering 95% of the dressing costs.

In current wound care there is an abundance of dressings available. Despite promises from manufacturers the evidence surrounding wound dressings is generally weak and practice is frequently based on anecdotal experience. Meta-analysis of studies comparing wound dressing did not show any difference between different types of dressings with respect to ulcer healing.[13]

A previous epidemiological study from Auckland on leg ulcers also demonstrated a large variation in treatment providers and treatment regimes.[14] Reducing variation in practice in the treatment of venous ulcers is a good target for reducing cost and improving outcome.

Several studies have shown that dedicated community leg ulcer clinics, increase healing rates, improve quality of life and are more cost-effective than district nursing home visits.[15,16] Direct input from vascular surgical services has been shown to lead to higher accuracy of ulcer diagnosis and identification of patients who might benefit from surgical intervention.[17,18]

The New Zealand guidelines for care of people with chronic leg ulcers are now 10 years old and probably need reviewing in light of the current data. Redistribution of resources will reduce ulcer recurrence and lessen the long term cost of managing this common problem.

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Venous ulcer management in New Zealand: usual care versus guideline recommendations

Andrew Jull, Natalie Walker, Varsha Parag, Peter Molan, Anthony Rodgers;
on behalf of the Honey as Adjuvant Leg Ulcer Therapy (HALT) trial collaborators

Aim To compare usual care with key recommendations for venous ulcer management in the *New Zealand Guidelines for Care of People with Chronic Leg Ulcers*.

Method A cohort of participants enrolled in the usual care arm of the HALT trial had their management compared to four treatment recommendations: compression (use high compression); dressing selection (use simple dressings); pentoxifylline (trial of treatment if not tolerant of compression or failure to progress with compression alone); and compression hosiery after healing (remain in hosiery after healing to prevent recurrence).

Results 181 participants were enrolled in the usual care arm, 25 in Auckland, 60 in Counties Manukau, 41 in Waikato, and 55 in Christchurch. *Compression*—all participants received high compression. *Dressings*—simple dressings accounted for just 29% of dressings used. Moist dressings and medicated dressings accounted for 35% and 36% of dressings respectively, but 95% of dressing costs. *Pentoxifylline*—only one participant used pentoxifylline when up to 97 (54%) were candidate patients. *Compression after healing*—70% of participants healed at 12 weeks used compression hosiery after healing with regional variation in use.

Conclusion Compression use was consistent with guideline recommendations, although hosiery use after healing could improve. Dressing selection and use of pentoxifylline did not match guideline recommendations. Three of the four guideline recommendations offer opportunities for improving clinical effectiveness, with some potential for cost savings.

Leg ulcers are defects in the epidermis, below the knee, which are present for more than 4 to 6 weeks.[1] Typically, leg ulceration is a chronic, relapsing, and remitting condition that is associated with impaired circulation. The main causal conditions are venous disease, arterial disease, diabetes, or unrelieved pressure over a bony prominence.

Venous insufficiency is the most common cause of leg ulceration, accounting for more than half of all ulcers on the lower limb and 67–70% of ulcers above the foot.[2,3] The period prevalence of leg ulcers in New Zealand has been estimated at 79 per 100,000 per year,[4] although capture-recapture analysis suggests a more accurate estimation is between 393 and 839 per 100,000 per year.[5]

In both New Zealand and overseas there is wide variation in treatments used in ulcer management, with large numbers of products employed.[1,6] Research in the United Kingdom indicates that such variation remains the case even after protocol-guided care has been implemented, although the variation in product use may be reduced.[7]

In 2000 the first New Zealand guidelines for leg ulcer management were disseminated.[8] The extent to which community-based management of venous ulcers

mirrors the guideline recommendations has not been assessed. Data from the control arm of community-based clinical trial on venous ulcers offers such an opportunity.

Method

Clinical trial—The Honey as Adjuvant Leg Ulcer Therapy (HALT) trial (ISRCTN 06161544) was a New Zealand-based pragmatic, open-label, randomised controlled trial to evaluate the effectiveness of manuka honey-impregnated calcium alginate dressings in addition to compression bandaging on venous ulcer healing compared to usual care.[9] Usual care consisted of the normal range of compression systems and dressings available to the district nurses at the study centre. Participants could also receive additional treatment for their venous ulcers as clinically indicated, either from the district nurse or from other providers, such as general practitioners or hospital-based practitioners.

Participants were recruited through four district nursing services (Auckland, Counties Manukau, Waikato, and the Nurse Maude Association in Christchurch). These services were selected because they had organised leg ulcer services and provided ulcer care that was likely to be consistent with that recommended in the New Zealand Guideline for Care of People with Chronic Leg Ulcers.[8]

Participants were recruited between May 2004 and September 2005 and were included if they were: aged 18 years or over; able to provide informed consent; had a venous leg ulcer; had an ankle-brachial index of 0.7 or greater; were able to be treated with compression at one of the study centres; did not have diabetes, rheumatoid arthritis, or peripheral arterial disease; and were not using honey on the ulcer.

Participants had face-to-face assessments at randomisation and at 12 weeks after randomisation. During the 12-week treatment period, district nurses provided data after each visit on healing status and the resources used during the visit. Costs were calculated using the resource data and the retail cost of the products. Participants were also contacted by telephone at 6 months after randomisation to assess ulcer recurrence and stocking use. Treatment duration was until healing or for 12 weeks, whichever occurred sooner.

Guideline recommendations—Four treatments from the guideline were selected to compare practice with guideline recommendations.

These treatments represent interventions that can be reasonably assured to have an effect on cost and/or effectiveness during an episode of care (Box 1).

The treatments were:

- *Compression bandaging*—Compression is available in a variety of bandaging systems which are applied tightly to the patient's lower leg from the toe to the knee. No particular system of high compression bandaging is advocated. Short-stretch bandaging is inelastic, usually applied as a single layer or perhaps over orthopaedic wool to pad the leg. Long-stretch bandaging is elastic and is also usually applied as a single layer or over orthopaedic wool. Three-layer and four-layer systems comprise a mix of bandages—such as orthopaedic wool, crepe bandage, an elastic bandage, and a cohesive bandage—each layer adding compression to the leg to achieve pressures of up to 40 mmHg.
- *Dressing selection*—There are a wide range of dressings available, which were aggregated into the following categories: simple, moist and medicated (Box 2).
- *Pentoxifylline*—Pentoxifylline is a methylxanthine derivative with fibrinolytic, rheological and antithrombotic activity.10
- *Compression after healing*—Venous ulceration is a chronic relapsing condition. For this reason, once a venous ulcer is healed, it is recommended patients go into compression hosiery to prevent future recurrence. Class 2 or 3 hose are appropriate. Different hose achieve different levels of compression: class 2 hose achieve about 30 mmHg of compression at the ankle and class 3 about 40 mmHg.

Box 1. Guideline recommendations

- Use high compression bandaging
- Use simple, low or non-adherent dressings acceptable to the patient
- Pentoxifylline for patients who do not tolerate compression or who do not respond to compression alone
- Use Class 2 or Class 3 compression hosiery after healing

Box 2. Categories of wound dressing

- Simple: silicon vicryl, paraffin gauze, cotton-based absorbent
- Moist: hydrogel, hydrocolloid, calcium alginate, hydrofibre, polyurethane foam
- Medicated: iodophor or silver impregnated

Results

181 participants received to usual care. The baseline characteristics of the participants by study centre are presented in Table 1.

Compression

171 (96%) participants were in multilayer compression, with 59% in four-layer compression and 36% in three-layer compression. Only 6% of participants were in single-layer systems (short-stretch or long-stretch compression). There was regional variation in preference for bandaging systems with 80% of participants in Auckland being in three-layer compression whereas 83% of Waikato participants were in four-layer compression (Table 2). Counties Manukau and Christchurch participants had compression split approximately 60:40 between four-layer and other systems.

Overall, compliance with compression bandaging (defined as being in compression for more than 75% of the district nursing visits over the 12-week treatment period) was 89%. Compliance was highest in Christchurch (98%), but similar in the remaining centres (84–85%).

Dressing selection

The frequency of dressings used is described in Table 3. The total number of dressings used (1823) was lower than the total number of district nursing visits (2196). This difference was in the main accounted for by the fact a dressing would not be used on the final district nursing visit when a patient's ulcer had healed.

Overall simple, moist, and medicated dressings each accounted for about one-third of dressings used. Across study centres, simple dressing use was broadly similar, but the frequency of moist and medicated dressing use varied by centre. For example, district nurses at Auckland DHB mostly used moist wound products for their patients, whereas Counties Manukau district nurses used mostly medicated products.

Within the product categories, there were also clear regional preferences with 99% of medicated dressings used in Counties Manukau being silver-impregnated, compared to 7% in Waikato and 36% in Christchurch.

The total spend on dressings was $17,191 in 2005 dollar terms. Expenditure on simple dressings was $832 (5%), on moist dressings was $6009 (35%) and on medicated dressings was $10,287 (60%).

Table 1. Characteristics of 181 participants in usual care arm by study centre*

Characteristic	ADHB N=25 (%)	CMDHB N=60 (%)	WDHB N=41 (%)	ChCh N=55 (%)	All N=181 (%)
Mean age (SD)	73.8 (15.0)	63.1 (19.0)	68.9 (14.5)	70.8 (16.5)	68.3 (17.1)
Female	14 (56)	29 (48)	18 (44)	31 (56)	92 (51)
Ethnicity					
NZ European	19 (76)	40 (67)	28 (68)	50 (91)	137 (76)
NZ Māori	3 (12)	11 (18)	12 (29)	4 (7)	30 (17)
Pacific Island	2 (8)	9 (15)	1 (2)	1 (2)	13 (7)
Asian	1 (4)	0	0	–	1 (1)
Mean ABI (SD)	1.1 (0.2)	1.0 (0.1)	1.1 (0.2)	1.1 (0.2)	1.1 (0.2)
Median ulcer area (cm^2)	3.7	2.6	1.8	3.0	2.6
Median ulcer duration (weeks)	21	18	11	18	16
Margolis Index					
0 (ulcer area ≤ 5cm^2 and ≤ 6 months duration)	10 (40)	29 (48)	22 (54)	23 (42)	84 (46)
1 (ulcer area > 5cm^2 or > 6 months duration)	8 (32)	26 (43)	15 (37)	19 (35)	68 (38)
2 (ulcer area > 5cm^2 and > 6 months duration)	7 (28)	5 (8)	4 (10)	13 (24)	29 (16)
Medical history					
Deep Vein Thrombosis	7 (28)	8 (13)	4 (10)	11 (20)	30 (17)
Joint replacement	6 (24)	7 (12)	2 (5)	11 (20)	26 (14)
Leg fracture	7 (28)	12 (20)	10 (24)	12 (22)	41 (23)

* Values are N (%) unless otherwise stated. SD is standard deviation. ADHB is Auckland District Health Board, CMDHB is Counties Manukau District Health Board, WDHB is Waikato District Health Board and ChCh is Nurse Maude Association, Christchurch. ABI is ankle:brachial index.

Table 2. Compression use by study centre*

Compression system	ADHB N=25 (%)	CMDHB N=60 (%)	WDHB N=41 (%)	ChCh N=55 (%)	All N=181 (%)
Compression bandaging					
Short-stretch bandage	1 (4)	1 (2)	0	3 (6)	5 (3)
Long-stretch bandage	0	0	0	5 (9)	5 (3)
Three-layer bandage	20 (80)	23 (38)	7 (17)	15 (27)	65 (36)
Four-layer bandage	4 (16)	36 (60)	34 (83)	32 (58)	106 (59)
Not compliant with compression	4 (16)	9 (15)	6 (15)	1 (2)	20 (11)

*Values are N (%). SD is standard deviation. ADHB is Auckland District Health Board, CMDHB is Counties Manukau District Health Board, WDHB is Waikato District Health Board and ChCh is Nurse Maude Association, Christchurch.

Pentoxifylline—Only one participant from Christchurch was receiving pentoxifylline at randomisation and no other participants were prescribed pentoxifylline during the 12-week follow-up.

Compression hosiery after healing—Overall 70% of the 90 participants who had healed at 12 weeks were using compression hosiery at 6 months after randomisation (Table 4). However, only 50% were wearing compression every day. There was considerable variation (17–50%) between the centres in the proportion of participants not wearing hosiery after healing.

Table 3. Dressings used by study centre*

Dressing	ADHB	CMDHB	WDHB	ChCh	All
Generic dressing type (e.g. trade name)					
Non-adherent (e.g. Adaptic)	101 (21)	141 (27)	85 (27)	116 (23)	446 (25)
Absorbent (e.g. Exudry)	2 (0.4)	8 (2)	10 (3)	56 (11)	73 (4)
Hydrogel (e.g. IntraSite)	20 (4)	0	4 (1)	33 (6)	57 (3)
Hydrocolloid (e.g. Duoderm)	1 (0.2)	11 (2)	6 (2)	–	18 (1)
Alginate (e.g. Kaltostat)	41 (9)	9 (2)	31 (10)	10 (2)	91 (5)
Hydrofibre (e.g. Aquacel)	57 (12)	27 (5)	37 (12)	113 (22)	234 (13)
Foam (e.g. Allevyn)	216 (45)	14 (3)	13 (4)	17 (3)	260 (14)
Silver-impregnated (e.g. Acticoat)	19 (4)	306 (59)	0	12 (2)	337 (19)
Iodophor (e.g. Iodosorb)	19 (4)	3 (1)	124 (40)	156 (30)	302 (17)
Other	–	–	3 (1)	2 (0.4)	5 (0.3)
Total	476	519	313	515	1823
Dressing category					
Simple	103 (22)	149 (29)	95 (30)	172 (33)	519 (29)
Moist	335 (70)	61 (12)	91 (29)	173 (34)	660 (36)
Medicated	38 (8)	309 (60)	124 (40)	168 (33)	639 (35)
Total	**476**	**519**	**313**	**515**	**1823**

* Values are N (%). Simple=non-adherent + absorbent; Moist = hydrogel + hydrocolloid + alginate + hydrofibre + foam; Medicated = silver-impregnated + iodophor. ADHB is Auckland District Health Board, CMDHB is Counties Manukau District Health Board, WDHB is Waikato District Health Board and ChCh is Nurse Maude Association, Christchurch.

Table 4. Use of compression hosiery after healing*

Use of compression	ADHB N= 8 (%)	CMDHB N=25 (%)	WDHB N=27 (%)	ChCh N=30 (%)	All N=90 (%)
Not used	4 (50)	7 (28)	11 (41)	5 (17)	27 (30)
Used 1–2 days per week	1 (13)	1 (4)	1 (4)	0	3 (3)
Used 3–4 days per week	0	3 (12)	0	1 (3)	4 (4)
Used 5–6 days per week	0	2 (8)	3 (11)	1 (3)	6 (7)
Used every day	3 (38)	12 (48)	12 (44)	23 (77)	50 (56)
Total	**8**	**25**	**27**	**30**	**90**

* Values in parentheses are percentages unless otherwise stated. SD is standard deviation. ADHB is Auckland District Health Board, CMDHB is Counties Manukau District Health Board, WDHB is Waikato District Health Board and ChCh is Nurse Maude Association, Christchurch. ABI is ankle:brachial index.

Discussion

The four elements of a treatment regimen reported here are the first occasion that usual care of patients with venous leg ulcers in New Zealand has been compared to guideline recommendations in centres with organised services for leg ulcer management. As such, this study demonstrates that adherence to guideline recommendations can serve as quality measures that indicate opportunities for improvement.

Use of multilayer bandaging systems in the HALT trial was consistent with guideline recommendations, as were regional preferences for different bandaging systems. The preference for multilayer systems may reflect current knowledge as four layer elastic systems have been shown to deliver better healing rates than short stretch systems.[11] However, there are two areas of incongruence with guideline recommendations, namely dressing selection and use of pentoxifylline. These inconsistencies offer clear

opportunity for improvement and cost saving. Furthermore, although compression hosiery use after healing was generally congruent with guideline recommendations, compliance varied by region and may also represent an opportunity for improving outcomes.

Dressing selection

There are no published New Zealand data specifically on the number of different types of dressings used in community-based management of venous ulcers. Internationally, audits reveal a variety of dressing products being used. A Swedish study found 51 dressings products being used in 294 patients,[6] while an English study found 36 different dressings used in the treatment of patients with venous ulcers.[7] With respect to dressings the central issue must be whether any dressing provides added benefit in terms of healing.

Three systematic reviews have found little evidence to support the view that any dressing, whether a simple dressing or a moist dressing, gives any benefit over compression alone.[12–14] Moist wounds have been found to heal faster than dry wounds. [15] Moist wound dressings are designed to ensure that the wound surface is kept modestly moist, either through the donation of moisture in the case of hydrogels, the retention of moisture in the case of hydrocolloids, or through absorption of excess moisture in the case of alginates, hydrofibres and polyurethane foam dressings. However, venous ulcers under compression tend to be moist and a simple non-adherent dressing will prevent adhesion of bandages to the ulcer surface. Absorbent dressings may also be required on occasion to prevent maceration.

A recent addition to the range of available dressings is the silver impregnated dressing. Silver dressings in contact with wound fluid have antimicrobial activity against a variety of bacteria and fungi.[16] However, these dressings tend to be the most expensive dressing option with the retail price for a 10 x 10 cm dressing being up to twice that of a similarly sized moist dressing and 19 times more expensive than a non-adherent dressing.

The most recent systematic review on this topic found a lack of evidence to support the routine use of silver dressings in ulcer care.[17] Despite this finding, silver impregnated dressings are in regular use in New Zealand, accounting for 19% of the dressings used and 38% of the total spend on dressings in the HALT trial. The other group of medicated dressings are iodophor dressings, which contain cadexomer iodine and have antibacterial properties.[18]

A systematic review has found some evidence suggesting cadexomer iodine dressings may improve healing rates when used in conjunction with compression (RR 6.7, 95%CI 1.6 to 29.0), but the trials were small and of short duration (4 weeks).[19] The implication of the review is that the evidence supporting the use of iodophor dressings is of limited reliability and such dressings should be used cautiously. Indeed, anything other than simple dressings should only be used when there is clear empirical need and all other evidence-based options have failed.

The New Zealand guideline recommendation for use of simple dressings needs to be considered in the light of the relative cost of such dressings. Although simple dressings accounted for about 29% of all usual care dressings in the HALT trial,

expenditure on these dressings was 5% of the total spend. Using simple dressings, such as silicon-impregnated vicryl, presents a real opportunity for cost saving in the treatment of venous ulcers.

Pentoxifylline

The almost complete absence of pentoxifylline as an adjuvant treatment among the participants in the HALT trial was a striking finding. The median period of ulcer duration prior to entry in the trial was 16 weeks, suggesting at least 50% of participants may have been candidates for treatment on the basis of the guideline recommendation.

Pentoxifylline has been shown to increase healing when used as an adjuvant to compression (RR 1.6, 95%CI 1.1 to 2.1) and to be the dominant economic strategy.[20] Pentoxifylline appears to be particularly effective with slow to heal ulcers (RR 2.4, 95%CI 1.7 to 3.2),[21] and such ulcers can be easily identified using a simple prognostic index. Thus candidate patients need not await treatment failure before being prescribed pentoxifylline. They can be prospectively identified using the Margolis index.[22] Using this prognostic index, up to 97 (54%) participants in the usual care arm would have been candidates for treatment with pentoxifylline.

The main reasons for the low use of pentoxifylline are likely to be organisational and economic. Full subsidy of the drug was removed in 2003 and patients are now required to make a co-payment of approximately nine dollars per script. For a patient willing to pay, the district nurse needs to liaise with the general practitioner to make a case for prescription, the general practitioner has to apply to HealthPAC for special authority to prescribe and the drug has to be obtained from a hospital pharmacy in some areas, or approved retail pharmacy in other areas.

Another barrier to use is that the PHARMAC schedule only lists the drug as oxpentifylline. If the general practitioner searches for pentoxifylline, no hits are returned. Without amelioration of the above barriers, an opportunity to accelerate healing in a large group of patients may be missed.

Compression hosiery

There is an opportunity to improve on the use of compression hosiery and reduce ulcer recurrence. Thirty percent of the 90 participants in usual care who had healed at 12 weeks were not wearing any compression hosiery at six months. An additional 14% were not wearing compression hosiery every day. Ulcer recurrence can be more than halved over five years by use of compression hosiery after healing.[23]

The guidelines currently recommend class 3 hosiery as being more effective than class 2 hose, a recommendation based on 3-year follow up data from the only trial that has compared the two systems.[24] A more recent publication of the five year follow up data from this trial found no significant difference between the two systems.[25] It is probably preferable to recommend patients start on class 3 hose and drop down to a lower level of compression in order to maintain compliance than the reverse strategy, although any level of compression is preferable to none. Use of compression hosiery appears to be influenced by belief in the worth of the stockings,[26] and practitioners may be able to influence this perception.

This secondary analysis of the HALT trial usual care arm is subject to limitations. The major limitation is that the trial participants may not reflect the typical experience of venous ulcer patients in New Zealand. It was not possible to determine how many patients were approached by district nurses to participate in the trial and thus how representative the sample may be. However, the HALT trial was a pragmatic trial with broad inclusion criteria and of the 392 potential participants notified to the researchers, 368 (94%) were randomised. There were no significant differences between participants registered and those randomised and it seems unlikely that patients outside of the HALT trial would have treatment regimens that more closely follow the New Zealand guidelines than those within the trial, especially in regions where there are no organised models of care for venous ulceration. Organised care has been shown to improve leg ulcer healing rates, better manage resource use and reduce costs compared to more naturalistically developed services.[7] Therefore regions without organised models of care for venous ulcer management may be presented with greater opportunities to improve outcomes.

A lesser limitation of this study is that random variation may account for some of the regional differences observed, particularly where the numbers were small, such as with variation in the use of compression hosiery after healing.

Conclusion

Use of compression, both during an episode of venous ulceration and after healing, was generally consistent with recommendations in the New Guideline for Care of People with Chronic Leg Ulcers. However, simple dressings were used less frequently than more complex, expensive options and pentoxifylline was almost entirely absent from the armamentarium of care. Increasing use of simple dressings and prescribing pentoxifylline in appropriate patients represent opportunities for cost saving and improving rates of healing in patients with venous ulcers. Compliance with use of compression hosiery after healing may also benefit from attention.

Competing interests: None. (The study sponsors had no role in study design, data collection, analysis or interpretation, writing of the report, or in the decision to submit for publication. The corresponding author had full access to all data in the study and had final responsibility for the decision to submit for publication.)

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Topical negative pressure wound therapy (TNPWT): current practice in New Zealand

Jacqui Laney, Justin Roake, David R Lewis

Abstract

Aim To survey current opinion, regarding TNPWT, from New Zealand vascular surgeons.

Method Registered vascular surgeons currently practicing in New Zealand were identified from the Vascular Society of New Zealand (VSNZ) database. A questionnaire was emailed asking if they used TNP in their vascular surgical practice and whether or not they considered themselves 'up to date' regarding published evidence for TNP. Surgeons were also asked how often and how successful they felt that TNP was in different clinical situations (arterial ulcers [after revascularisation]; venous ulcers; mixed arterial/venous ulcers; following debridement of the 'diabetic (Db) foot'; lower limb (LL) surgical wound infections/dehiscences; and lymphocoeles/seromas/lymph fistulas not treated successfully with conservative management). One email reminder, followed by a hard copy reminder was sent to those who failed to respond to the first email.

Results Of 38 vascular surgeons 34 responded (89.5%). Median response time was 3.38 days (range 12 min–11.8 days). 28 (82%) vascular surgeons used TNP in their NZ clinical practice. 17 (50%) considered themselves up to date regarding published evidence, 8 (23.5%) admitted to not being up to date with the evidence and 9 (26%) did not know. TNP appears to be used most frequently and with most success following debridement of diabetic foot wounds and in the management of infected/dehisced surgical wounds.

Conclusion TNPWT is widely used by NZ vascular surgeons, despite many not considering themselves up to date regarding published evidence. It is most favoured for treating diabetic feet post debridement and for lower limb surgical wounds.

Topical negative pressure (TNP) is also known as vacuum assisted closure (VAC), sub-atmospheric pressure dressing (SPD), vacuum sealing technique (VST), foam suction dressing, sealed surface wound suction (SSS), vacuum pack therapy, and sealing aspirative therapy.[1–3] It is the application of a local sub-atmospheric pressure across a wound.[4]

TNP is used both as primary treatment of chronic and complex wounds; and as an adjunct for temporary closure and wound bed preparation before definitive surgical procedures—e.g. wound bed preparation pre skin grafts.[4,5] TNP has been recommended for a variety of acute and chronic wounds including pressure wounds, diabetic leg ulcers, lower leg wounds, traumatic wounds, burns, infected wounds, necrotizing fasciitis, infected sternal wounds, and after skin grafting.[1,3,6]

TNP therapy does not replace surgical wound debridement, measures to improve blood circulation, or relevant treatment of infection.[6] TNP may also be useful to stabilise wounds in patients not well enough to be considered for surgery.[4,5]

It has been proposed that TNP promotes wound healing through a number of mechanisms. These include oedema reduction, increased wound/dermal perfusion, increased granulation tissue stimulation, decreased bacterial loading and enhanced wound exudate removal.[2–5,7,8]

A recent meta-analysis concluded that only increase in blood flow appears to be proven, whereas the actual mode of action of TNP still remains unclear.[4,5,9] There is still a paucity of data on optimal duration of TNP, however it seems to have its greatest effect in the early stage of wound healing.[5]

Complications associated with TNP include decreased mobility, pain, pressure necrosis, haemorrhage, haematoma, infection, and toxic shock.[1–4,7] Topical negative pressure is contraindicated where there is necrotic tissue or eschar. The therapy should not be placed directly over exposed organs or blood vessels, untreated osteomyelitis, non-enteric or unexplored fistulas or malignancy in the wound.[1–4] TNP should be used with caution in patients with difficult wound haemostasis, with active bleeding or taking anticoagulants.[1–4]

The clinical evidence supporting the use of TNP has been largely based on clinical perception, case series, small cohort studies and weakly powered RCT's, constituting a large amount of low level evidence.[10] Most published studies on TNP are poorly designed and therefore its use in surgical practice remains controversial. In 2006, an updated Health Technology Policy Assessment regarding TNP was published from Canada.[1] The assessment reviewed seven international health technology assessments on TNP and found that TNP was consistently reported as being helpful for healing a variety of wounds. However, the effectiveness of TNP could not be quantified because of the poor methodological quality of studies.[1]

Two recently published systematic reviews concluded that there remains a lack of clinical evidence to support the use of TNP over more conventional treatments.[6,7] Despite this, the use of TNP has increased substantially for treating a variety of clinical scenarios. It has been suggested that because TNP is readily available and easy to administer compared with multiple daily conventional dressing changes, it has the potential to be used inappropriately.[1]

The aim of this audit was to establish current opinion regarding TNP from vascular surgeons practicing in New Zealand.

Method

Vascular surgeons currently practicing in New Zealand were identified using the Vascular Society of New Zealand (VSNZ) database. A questionnaire was emailed to identified surgeons asking how often and how successful the surgeons felt that TNP was in a variety of common clinical situations (i.e. arterial ulcers (after revascularisation); venous ulcers; mixed arterial/venous ulcers; following debridement of the 'diabetic (Db) foot'; lower limb (LL) surgical wound infections/dehiscences; and lymphocoeles/seromas/lymph fistulas not treated successfully with conservative management).

The responses were graded for use of TNP as always, often, sometimes or never; and success was graded as very good, good, average, poor or none. Surgeons were also asked if they used or recommended TNP in their vascular surgical practice and whether or not they considered themselves 'up to date' regarding published evidence for TNP.

A week later, a second email was sent to non-responders asking them to complete and return the questionnaire. Finally, a week later, a third reminder was sent by post with an enclosed postage paid, self addressed envelope asking surgeons to send their response back.

If email addresses were not available surgeons were sent a hard copy of the questionnaire by post in the first instance.

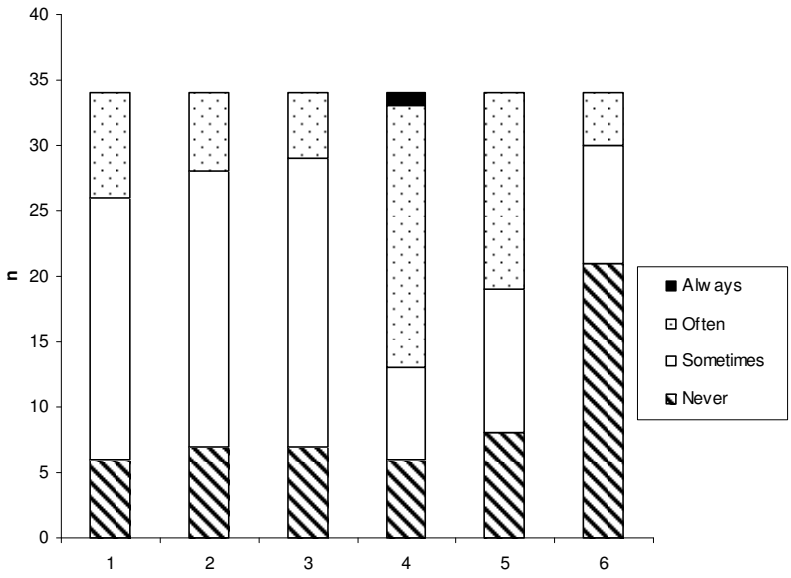
Results

Thirty-nine vascular surgeons are registered on the VSNZ database, however this included one radiologist who was excluded from the current audit (therefore n=38); 34 surgeons responded (response rate of 89.5%). The median response time was 3.38 days (range 12 min–11.8 days); 16 (47.1%) responded to the initial email, 8 (23.5%) to the second reminder, and 10 (29.4%) to the third. Of those surgeons who responded, 47% replied electronically and 53% replied on paper.

Twenty-eight (82%) vascular surgeons in NZ used TNP in their clinical practice, however only 17 (50%) considered themselves up to date regarding published evidence for TNP. Eight surgeons (23.5%) considered that they were not up to date with the evidence and 9 (26%) were not sure whether or not they were up to date. Six (18%) surgeons did not use TNP in their vascular surgical practice.

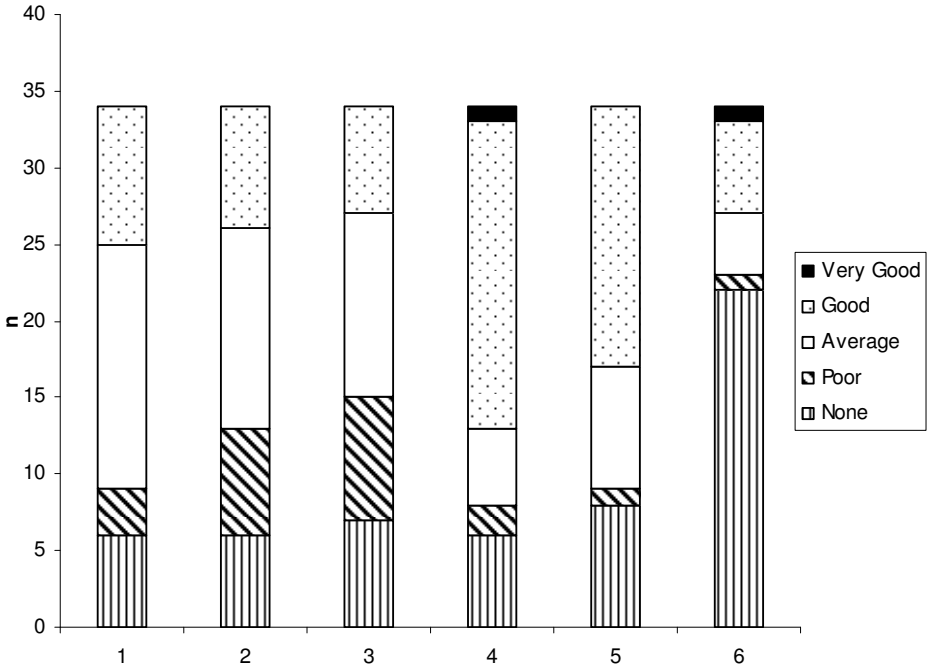
The use of TNPWT for different wounds is presented in Figures 1 and 2, and Table 1.

Figure 1. How often TNP is used in above clinical situations by New Zealand vascular surgeons



1=arterial ulcers; **2**=venous ulcers; **3**=mixed arterial/venous ulcers; **4**=following debridement of the diabetic foot; **5**=lower limb surgical wound infections/dehiscences; **6**=lymphocoeles/seromas/lymph fistulas not successfully managed conservatively.

Figure 2. How successful TNP is considered when used in various clinical situations by New Zealand vascular surgeons



1=arterial ulcers; **2**=venous ulcers; **3**=mixed arterial/venous ulcers; **4**=following debridement of the diabetic foot; **5**=lower limb surgical wound infections/dehiscences; **6**=lymphocoeles/seromas/lymph fistulas not successfully managed conservatively.

Surgeons were invited to submit any relevant comments with their responses. Three surgeons not using TNP were limited by its availability in their institutions. One surgeon commented that he sees little point in using TNP, particularly if an ulcer is treated by good compression. Regarding persistent lymphatic leakage, one surgeon thought that there was some logic in using TNP, although in this situation he felt that patients often do not present to a hospital setting.

Discussion

A chronic wound is defined as a wound that does not heal in an orderly set of stages and in a predictable amount of time the way most wounds do; wounds that do not heal within three months are often considered chronic.[11] The vast majority of chronic wounds can be classified into three categories: venous ulcers, diabetic wounds, and pressure ulcers.[12,13]

Management of chronic wounds remains costly and challenging to health practitioners. They can also impose significant emotional and physical stress to patients. Topical Negative Pressure (TNP) is becoming widely accepted as a first line treatment in the management of a variety of wounds. Negative pressure has been used as part of the treatment of wounds in the form of various drains since the 1940's.[6] Its use in encouraging healing of open surgical wounds, diabetic foot ulcers and chronic

non-healing wounds has been widely studied. Unfortunately most published studies on TNP are poorly designed and therefore recommendations for its use in surgical practice remain controversial—both clinically and economically.

A systematic review of topical negative pressure therapy for acute (split skin grafts, diabetic foot amputation) and chronic (venous, arterial, diabetic or pressure) wounds was recently published.[7] Fifteen relevant publications of thirteen RCT's evaluating effectiveness of TNP for patients with chronic wounds, diabetic wounds, pressure ulcers, skin grafts and acute wounds were included.

The authors concluded that these studies contained no aggregate evidence for more relevant wound healing for any type of wound when using TNP and that TNP should not routinely be promoted for use in local wound care.[7] The authors also emphasised the flaws seen with the study designs including invitations for selection bias, insufficient follow up periods and use of surrogate (yet clinically irrelevant) endpoints, differing endpoints between studies and differing control treatments meaning meta-analysis could not be performed.[7]

Individual trials suggested that chronic and diabetic wounds treated with TNP appeared to be ready for secondary closure surgery between one to ten days earlier, however this came at a cost of increased complications (including two cases of sepsis in the TNP group). The authors of the review also argued that ten days difference is negligible given that the nature of these wounds often means that they take many months to heal.[7]

In another systematic review published the same year, the authors considered the effectiveness and safety of negative pressure wound therapy (NPWT) for problematic wounds including pressure wounds, post-traumatic wounds, diabetic foot ulcers and miscellaneous chronic ulcers.[6]

Of the fourteen RCTs reviewed, twelve were included in the systematic review discussed above,[7] plus an additional two part study.[14] The authors reported that the methodological quality was poor in most studies and that only two trials were considered to have good internal validity.[6] Despite the poor methodological quality of most papers the authors suggested that tentative evidence suggests that NPWT appears to be at least as effective, if not more effective, than other available local wound treatments.[6]

The most promising results were obtained in patients with lower leg vascular ulcers, diabetic foot ulcers and split thickness skin grafting.[6] The main adverse events when using TNP appeared to be infection, irritation of the skin and pain when changing the dressing, however these were reported as mild and overall TNP appears to have an acceptable safety profile.[6]

Two studies included in the review attempted to calculate costs between TNPWT and alternative modern wound care products, one of which found no difference between therapies.[15] The other calculated that TNPWT was less costly than that of the reference therapy, US$3381 compared with $5452,[15,16] however the extent to which the equipment outlay was taken into consideration was unclear in the cost analysis.[6]

Theoretically TNP may become more cost effective as less expensive newer technology emerges. Faster healing times may result in shorter hospital stays and less

demand on health care systems. As there is a longer time between dressing changes with TNP, there is less demand on nursing staff. Braakenburg (2006) suggested that although overall costs between TNP and traditional wound therapy were similar, TNP resulted in improved patient comfort and decreased time and cost of nursing staff.[15]

The systematic reviews concluded that the lack of well-designed RCT's evaluating the efficacy of TNP, means that no firm findings can be drawn from them.[6-7] Individual papers tended to present more favourable findings.

Armstrong et al investigated TNP for its use in acute wounds following diabetic foot amputation.[10] Ubbink et al. argued that although there was a 17% earlier wound healing time (number needed to treat was six), there was an 11% higher infection rate (number needed to harm was nine) in the TNP group.[7] Armstrong et al reported that none of these infections were treatment related.[6,10]

A large multicentre randomised controlled trial enrolled 342 patients to evaluate the safety and clinical efficacy of negative pressure wound therapy (NPWT), compared with advanced moist wound therapy (AMWT), to treat foot ulcers in diabetic patients.[17] They concluded that a greater percentage of foot ulcers achieved complete wound closure with NPWT (43%) compared with AMWT (29%) within the 112 day active treatment period.[17]

Significantly fewer secondary amputations were required in the NPWT group whilst there was no significant difference observed at 6 months between the two groups in treatment related complications.[17] NPWT appears to be as safe and more efficacious than AMWT for treating diabetic foot ulcers.[17]

It has been documented that TNP leads to a significant improvement in the wound management of recalcitrant chronic lower limb ulcers (venous, mixed and arterial) that require skin graft operations.[16] Despite increased success of skin grafting in patients using TNP, there was no difference in ulcer recurrence rates.[16] The number of patients recruited in this study was too small to enable a sub group analyses for different types of chronic leg ulcer.

McCallon had earlier reported that TNP is useful for large venous ulcers, but arguably had no impact on arterial ulcers and those with persistent arterial deficiency and persistent local ischaemia.[18] Experimentally, TNP results in no improvement in micro-circulation in ischaemic human lower limbs.[19]

In the current audit, vascular surgeons in New Zealand used TNP most often following debridement of the diabetic foot. TNP was used less frequently for treating arterial ulcers (after revascularisation), venous ulcers and finally mixed arterial/venous ulcers. It was used only sometimes or never by 76% (arterial), 82% (venous) and 85% (mixed arterial/venous) of New Zealand vascular surgeons.

The surgeons questioned found that they had the most success when using TNP following debridement of the diabetic foot, with 62% of them saying that they had good or greater success in this scenario. This is in keeping with current literature that suggests that TNP may lead to more rapid wound healing following surgery to the diabetic foot.[10]

Vascular surgeons in New Zealand reported less success when using TNP for arterial, venous and mixed ulcers. Less than 26% of surgeons had anything better than good

success when using TNP for treating ulcers of any aetiology. TNP may accelerate healing in patients with chronic venous ulcers who are also treated with bed rest and punch grafts,[2,16] however there is no evidence to support its use in arterial ulcers.

Despite some evidence to suggest the benefits of TNP for treating venous ulcers, this is not reflected in the experience and opinion of New Zealand vascular surgeons - it is more frequently used in New Zealand to treat arterial ulcers. TNP may not be the favoured method for treating venous ulcers, given that more traditional compression therapy continues to prove beneficial.

One report has been published of TNP successfully managing a MRSA infected/dehisced femoro-popliteal bypass surgical wound in a diabetic patient.[20] A larger series reported 33 patients with femoro-popliteal bypass graft post op groin infections and their subsequent treatment with TNP.[21] Although there was no control group, the authors reported significant adverse effects of TNP in this population - including serious TNP associated bleeding and late false aneurysm formation.[21] TNP treated graft infections were associated with a high risk of developing infection-related complications.[21] Non-healing surgical site infections were associated with amputation and death. [21]

No RCTs have reviewed the use of TNP for treating lower limb surgical wound infections/dehiscences. Despite this, this was the second commonest situation that TNP was used for by New Zealand surgeons. 45% of surgeons used TNP often for treating lower limb surgical wound infections/dehiscences, with 50% perceiving success as above average. More RCTs are needed, evaluating the use and safety of TNP for treating these wounds, before its routine use can be justified.

No papers have been published specifically evaluating the effectiveness of TNP for its use in lymphocoeles, seromas or lymph fistulas. The results of this audit suggest that it is rarely used in New Zealand for this—62% questioned had never used TNP in this clinical situation, the most frequent of all responses.

Despite this one surgeon rated that TNP was very good for treating lymphocoeles, seromas or lymph fistulas that were difficult to control with conservative measures and 21% of surgeons rated that they had good success. Its use in this scenario seems to be based entirely on anecdotal favourable clinical experience.

It would seem that use of TNP derives mostly from personal experience. The results of this audit suggest that 50% of surgeons in New Zealand using TNP admit to not being currently up to date with published research. The criticism of the published literature apparent in recent systematic reviews might caste some clinical doubt on the role of TNP. There is however a gradually expanding evidence base allowing clinician's to make informed choices for optimal use of TNP.[4]

Individual trials suggest that TNP may be beneficial in treating diabetic foot ulcers, venous ulcers and arterial ulcers (post revascularisation). Systematic reviews challenge the validity of these results, given the poor methodological quality of many of these RCTs.[6,7] As a consequence, definitive conclusions and clinical guidelines for the use of TNP are difficult to formulate and remain controversial. There still remains a large gap between evidence based data and routine clinical experience.[5] Although TNP appears effective, it still remains unclear as to whether or not it is more effective than other wound closure techniques.[22]

The technology of TNP is continuously advancing, with impregnated foams and gauze containing growth factors or other agents (e.g. silver for altering wound environment) being introduced to the market.[4] This will add to the difficultly of drawing conclusions through systematic reviews and meta-analyses, because to date none of the RCTs have used this technology.

Currently in New Zealand TNP is most commonly used for diabetic foot wounds post debridement, lower limb surgical wounds and arterial followed by venous ulcers, with perceived success correlating with this order of popularity. There is a need for surgeons in New Zealand to understand the controversies regarding TNP.

Note: Results of the audit were recently presented at the Vascular Society of New Zealand annual conference in Tauranga, February 2009.

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Screening for diabetes, impaired glucose tolerance, and cardiovascular risk in primary care: a Northland, New Zealand pilot study

Bronwyn White, Nick Chamberlain

Aim To describe the results of a pilot project of diabetes screening in a high risk general practice population.

Method Adequacy of follow-up of fasting plasma glucose (FPG) tests and recording of cardiovascular risk scores was analysed, and the prevalence of diabetes and impaired glucose tolerance (IGT) was calculated using WHO diagnostic criteria.

Results In a registered population of 28,000, 1251 people were screened for diabetes of which 1129 (90.2%) completed the screening pathway. Diabetes was detected in 3.6% (n=24) of Māori and 2.0% (n=9) of non-Māori. There was no statistical difference between uptake to oral glucose tolerance (OGT) for Māori and non-Māori. Eighty percent (n=1002/1251) of people screened for diabetes had a Cardiovascular Risk Assessment (CVRA). This occurred less frequently in Māori (76.6%, 576/752) compared to non-Māori (85.4%, 426/499), p=0.0001.

Conclusion The consequences of low uptake of OGT ranged from underestimated prevalence estimates to underestimated CVD risk scores. Increased follow-up of raised FPGs is required. Because CVRA uptake was lower in Māori, caution is advised against reliance on CVRA programmes as the sole mechanism to identify Māori with diabetes or IGT. Further investigations into the use of HbA1c as a screening or diagnostic test are recommended for high risk groups.

Reducing the incidence and impact of diabetes is one of the thirteen priority population health objectives in the *New Zealand Health Strategy*.[1] Diabetes is also one of eight Māori health-gain priority areas.[2] Targeted screening for Type 2 diabetes is recommended in combination with cardiovascular disease (CVD) risk assessment.[3] This is because reducing the impact of CVD risk factors (not diabetic control) remains the best approach to prevent CVD in people with Type 2 diabetes and impaired glucose tolerance (IGT).[4]

In New Zealand, most diabetes screening activity is opportunistic and occurs in general practice. Thus, barriers to accessing primary care will impact on the benefit of opportunistic screening. From 2001 the development of targeted diabetes and CVD screening programmes was encouraged.[3,5] Little was known about how effective systematic screening for diabetes was in general practice for reaching those with high risk.

Around this time, the Predict-CVD risk assessment tool was developed. A fasting plasma glucose test (FPG) is included in the recommended investigations for CVRA. People with a higher risk of diabetes, and a FPG result above 5.5 mmol/L are recommended to have a follow-up oral glucose tolerance (OGT) test as some of these people will have diabetes or impaired glucose tolerance.[6] Therefore, as cardiovascular risk assessment (CVRA) programmes are implemented, it is expected that diabetes screening and diagnosis will be improved.[7]

With an intended focus on detecting undiagnosed diabetes, the Northland Diabetes and CVD Risk Screening Pilot (2004–2007) also piloted the feasibility of using practice recall systems for the detection of diabetes.

The objective of this paper is to describe the results of the pilot study of diabetes and IGT screening in general practice. The findings are discussed with a particular focus on pathway effectiveness and equity in the context of CVRA programmes.

Methods

Four general practices with a total registered population of 28,000, were included in the pilot study. Practices were a mixture of rural and urban. In recognition of the importance of enabling access to services for Māori, an iwi (tribal) provider was contracted to provide an outreach service and screen opportunistically in the community. The pilot was developed and approved by staff at Northland District Health Board (DHB) and funded by the Ministry of Health.

The inclusion criteria for being invited for screening differed from New Zealand Guidelines Group in that age was not defined by gender. Criteria were:

- All Māori and Pacific Island people >35 years of age and European>50 years of age, or
- 10 years younger if in combination with one or more of the following risk factors: BMI>30 (kg/m^2), 1st-degree relative with Type 2 diabetes, hypertension, triglycerides >2.8 mmol/L, low HDL cholesterol, polycystic ovary syndrome, or a history of CVD.

Exclusion criteria were known diabetes or a fasting plasma glucose <5.5 mmol/L in the past year.

Due to funding constraints, the maximum number of people to be screened was 2200. A target number of patients to be screened by each practice was determined based on the practice age/sex registers.

1800 Māori were identified and invited. The number of non-Māori was not recorded. Invitation letters were sent out to eligible patients by practice staff. The letter explained the purpose of the pilot study, and included fasting instructions, a lab form, and an informed consent form. Laboratory forms were labelled with a sticker designed to allow easy identification by the laboratory. Patients who did not have a recent fasting lipids test result were sent an additional form.

Patients had the option of attending one of the laboratory collection rooms their practice or being visited in their homes as part of outreach provider activity, for the FPG test. FPG results were sent to the requesting practitioner for appropriate action.

Patients who presented at appointments and met any of the above criteria were also invited to participate (opportunistic screening).

In line with the NZGG Diabetes Guideline, all patients with a FPG result ≥5.5 mmol/L were required to have an OGT test. Although the guidelines state that either a repeat FPG >7.0 or OGT test is required to confirm a diagnosis of diabetes,[6] in this study patients with FPGs results ≥7.0 mmol/L were required to have an OGT test to confirm diabetes.

Patients with FPG results ≥ 11.1 mmol/L and no OGT result, were accepted in this study and classified in the diabetes category. All patients screened for diabetes were required to have a CVRA. All providers had access to Predict-CVD to calculate CVD risk as part of the pilot protocol.

Patient details, ethnicity, doctor, FPG result, CVD risk score, method of recruitment, and follow-up OGT test results, were recorded onto an Excel spreadsheet designed and maintained by Northland Pathology Ltd.

Monthly spreadsheets were sent to Northland DHB, where data was monitored and informed the monthly progress reports and payments to providers. Northland DHB sent monthly spreadsheets to each general practice with a cumulative list of their patients that had been screened, the results of the FPG, OGT (if necessary), and CVRA score.

Ethnicity was analysed in two groups; Māori (n=752), and non-Māori (European n=484, and Pacific Island, Asian, and other ethnic groups total n=15).

Incomplete screens were defined as those with FPG results between 5.5–11.0 mmol/L and no recorded OGT test. Completed screens were defined as all FPG less than 5.5 mmol/L, recorded OGT and FPG

results ≥11.1 mmol/L. In determining uptake to OGT testing, only those with FPG results between 5.5–11.0 mmol/L were included (Table 1).

Two-tailed Fisher's exact test of independence was used to determine any significant differences in uptake to diagnostic testing and a recorded CVRA between groups.

Prevalence of diabetes and IGT was calculated using World Health Organization (WHO) diagnostic criteria[21] from all participants with completed screens to give crude detection rates. These were also broken down by ethnic category and age group (<45, 45–54, 55–54, 65+ years).

Results

Between July 2004 and September 2006 there were a total of 1251 people screened. Of these, 11.8% (n=148/1251) were screened by opportunistic screening. From the 1800 Māori identified and recalled by practice staff, 41.8% (n=752/1,800) participated in the pilot study. By ethnicity, the greatest proportion of people screened (60%) were Māori and overall, there was slightly more females screened (n=664, 53%).

Figure 1 shows an overview of the pilot results. Of the 752 Māori screened, 668 (89%) completed the screening and diagnostic pathway from which 3.6% (24/668) were diagnosed with diabetes and 3.0% (n=24/668) with IGT. For non Māori, 451/499 (90%) completed screening from which 2.0% (9/451) were diagnosed with diabetes and 2.2% (10/451) met criteria for IGT. Uptake to OGT was similar for Māori (54.1%) and non Māori (51.5%).

The results are shown in more detail in Table 1. Māori under 45 years of age had the lowest proportion of recorded OGT results; however in all other age categories, around 60% of Māori with a positive FPG, had a recorded OGT result.

View Table 1 and Figure 1 here.

The distribution of diagnostic testing by FPG category was compared with uptake to OGT as shown in Table 2. Two percent of the total number screened had a FPG result between 7–11.0 mmol/L and as expected, of those who had an OGT test, most were positive for diabetes (n=11/14, 78.6%). Around 20% of the total screened had a FPG result between 5.5–7 mmol/L. Around 40% of people with screening-detected diabetes (n=13/33) and almost all people detected with IGT (33/34, 97%), were in this range.

Table 2. Fasting plasma glucose (FPG) results of the population screened and prevalence of screening-detected diabetes and impaired glucose tolerance (IGT)

FPG mmol/L			Recorded OGT		Diabetes		IGT		OGT result < 7.8 mol/L	
	n	%	n	%	n	% **	n	%**	n	%**
<5.5	960	(76.7)								
5.5-6.0	189	(15.1)	96	(50.8)	4	(4.2)	16	(16.7)	76	(79.2)
6.1-6.9	68	(5.4)	40	(58.8)	9	(22.5)	17	(42.5)	14	(35.0)
7- 11.0	25	(2.0)	14	(56.0)	11	(78.6)	1	(4.0)	2	(14.3)
≥ 11.1	9	(0.7)	3	(33.3)	9	(100.0)	-	-	-	-
Total	**1251**	**(100)**	**150***	**(12.2)**	**33**	**(16.0)***	**34**	**(22.7)**	**92**	**(61.3)**

* Excludes FPG ≥ 11.1mmol/L; ** percentage of recorded OGT.

A total of 80.1% (n=1002/1251) of people screened for diabetes had a recorded CVRA, as required by the study protocol. Overall, the difference between the proportion of Māori (76.6%, 576/752) and non-Māori (85.4%, 426/499) was significant (p=0.0001).

Recorded cardiovascular risk was assessed by ethnic category according to diabetes screening results grouped into three categories—negative FPG, positive FPG and OGT or FPG ≥11.1mmol/L, and required but no recorded OGT—as shown in Table 3.

A lower proportion of Māori had a recorded CVRA in each category compared with non-Māori and this difference was significant in the negative FPG category. CVRA was recorded for 74% of patients with raised FPGs who did not have a recorded OGT test.

Table 3. Count and percentage of recorded CVRAs compared with diabetes screening categories by ethnic category

	No. screened	Recorded CVRA (%)		P value
Negative FPG				
Maori	562	433	(77.0)	0.0002
Non-Maori	398	344	(86.4)	
Sub total	*960*	*777*	*(80.9)*	
Positive FPG & OGT or FPG 11.1+				
Maori	106	83	(78.3)	Ns
Non-Maori	53	44	(83.0)	
Sub total	*159*	*127*	*(79.9)*	
Positive FPG & no OGT				
Maori	84	60	(71.4)	Ns
Non-Maori	48	38	(79.2)	
Sub total	*132*	*98*	*(74.2)*	
TOTAL	**1251**	**1002**	**(80.1)**	

Discussion

The results show a screening-detected diabetes prevalence of 3.6% for Māori and 2.0% for non-Māori. Although follow-up of raised FPGs was equitable between Māori and non-Māori, the overall lack of uptake of OGT testing limited case detection. Of particular concern was the proportion of people with incomplete screening results who had a CVRA. Clearly, a proportion of people in this group could still have diabetes thus their CVD risk scores underestimated. The difference in recorded CVRA between Māori and non-Māori participants was more likely in those with negative FPG results.

Diabetes prevalence modelling had suggested that the proportion of undiagnosed diabetes could be as high as 50%.[5] Recent evidence indicates that it may be much lower.[8,9] For diabetes screening programmes, a reduced proportion of undiagnosed diabetes means a reduced yield and an increase in the number needed to screen,[10] to detect one new case.

Although this helps to explain why the screening-detected diabetes prevalence was lower than expected, the screening-detected diabetes prevalence in this sample was a probable underestimate because case detection was limited by poor uptake of OGT. If a similar distribution of diabetes and IGT is assumed in those who did not have an OGT test, then the magnitude of this underestimation could mean a missed opportunity to potentially identify an additional 21 people with diabetes and 29 people with IGT.

It was also possible that those with highest risk are those who did not participate. Uptake of screening for Māori was low and unknown for non Māori, (as only eligible Māori on the Age-Sex register were recorded, the number of non-Māori who did not respond to recall attempts cannot be determined).

Another limitation was that there was no attempt to determine the range of risk factors in the sample screened. Most were identified based on age and ethnicity from practice registers, and others were identified based on co-morbidities, or other risk factors; thus limiting the ability to describe the sample screened. However, this study offers a real world setting and therefore a realistic view of screening detection rates and the NZGG diabetes screening pathway.

Few New Zealand comparisons for diabetes screening could be made. Because of the similar target population and setting, findings from CVRA research were examined, however at the time of writing, no research was found which reported the number of new cases of diabetes and IGT detected as a result of targeted recall.

When looking at comparable studies in other countries, the pilot evaluation reflected similar practice difficulties and uptake barriers such as; identifying who to screen, reaching those most at risk, and low uptake of OGT testing.[11,12] These issues correlate closely with CVRA focused research which have highlighted that improved information collection;[13] increased uptake of screening in ‘hard to reach’ populations;[14] and better risk factor documentation,[15] would enhance the implementation of CVRA in primary care.

Although general practice documentation was not audited for the current study, the issue of documentation was raised in the evaluation of pilot studies set in 24 general

practices, England. [16] A recent New Zealand study showed that diabetes status—including documentation of diabetes as not present-—was observed in only 16% of electronic medical records. [15]

This study showed that CVRA was calculated for 74% of patients with incomplete screens. Given that diabetes is a risk factor which increases CVD risk score, efforts to improve follow-up and documentation should be made. It is expected that the improved risk assessment and decision support tools should help improve documentation, and may provide a prompt to follow up FPG results.

A fundamental consideration raised in the pilot evaluation and by others,[16,17] was that there needs to be capacity to screen and to care for those with screening-detected diabetes and IGT. Also, the introduction of systematic recall programmes will invariably mean that increased OGT testing would be likely because more people would be screened at an earlier level of glucose intolerance.[18] Clearly, these issues have workforce implications for general practice and the wider primary and secondary care sector.

Due to general practice capacity constraints, strategies to identify the most people with Type 2 diabetes could be considered before identifying people with IGT. For example, if this study had used the FPG cut-off of 7 mmol/L, 2% of total sample would have required diagnostic testing and 60% of those screening-detected would have been discovered.

But to detect the remaining 40% of screening-detected diabetes and almost all screening-detected IGT, a further 20% of the total number screened required an OGT test, as per NZGG.[6]

With the difficulties of screening high-risk populations it is important that inequalities are not increased. Even though FPG results ≥7.0 mmol/L could have a repeat FPG to confirm diagnosis,[6] the OGT test poses a barrier to effective screening for diabetes.[8,12] Although HbA1C is not recommended by the WHO for use as a screening test,[19] it might be time to continue discussions on using it as a diabetes screening or diagnostic test[20] and to assess whether the risks and benefits outweigh consequences of opportunities missed by the OGT test, for people most at risk.[21]

Given that Māori have a much higher risk of developing diabetes, and at a younger age, great care must be taken to improve the equity of uptake for CVRA programmes if it is to be the sole strategy to improve the detection of diabetes and IGT.

This study showed that recorded CVRA were less likely for Māori than non-Māori, although inclusion criteria meant that the participants were younger than what would be expected via systematic CVRA. Even so, other studies suggest that Māori will be less likely to have CVRA -mainly because of low uptake and inequity in risk factor documentation in general practice.[15,22]

Some strategies are suggested:

- Improve risk factor documentation by rewarding CVD risk recording in high-need populations through the PHO Performance Programme.
- General practice could identify patients that rarely access traditional primary care services, who could be screened in their homes, and form partnerships with Māori and Pacific Island providers to provide care.

While general practice is the setting for most screening activity, outside of general practice, intersectoral efforts should continue to increase community capacity building to improve social networks and the impact of the physical environments on those with higher deprivation. These activities, alongside targeted social marketing and other areas of health promotion, would encourage community-based screening and improved access to primary care.

Further research in diabetes as a continuous measure of glucose intolerance versus diabetes as an arbitrary cutoff (i.e. the 2 hour post prandial cutoff of 11.1mmol/L) may help reduce the barrier posed by the reliance on OGT testing for FPG results in the equivocal range. Also, questions are yet to be answered about primary cares' capacity to treat newly detected IGT and diabetes.

A review of the 2003 Diabetes and CVD guidelines is being completed by NZGG and some of the outcomes of this review may significantly impact on the way diabetes and CVD risk screening is performed in the future. However, there is little point having a more effective and evidence-based screening programme if these issues aren't addressed and appropriately resourced.

The consequences of low uptake of OGT testing in this study ranged from underestimated prevalence estimates to underestimated CVD risk scores. The implications affect policy decisions, practice capacity, resource needs, and treatment plans - all of which ultimately impact on the health outcomes for the patient and their families, whose diabetes or IGT has not been detected.

The use of HbA1c may be the test of choice in the future for screening high risk populations. Finally, caution is advised against reliance on CVRA programmes as the sole mechanism to identify people with diabetes or IGT.

Competing interests: None known.

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Management of adult superficial acute abscesses in a tertiary hospital: time for incisive action

Jannah Baker, John Windsor

Abstract

Aim Reduction in length of inpatient stay is an important factor in reducing healthcare costs in many hospital systems. This paper examines trends in hospital stay over time for general surgical patients presenting with abscess, and outlines the potential benefits if a day case service for acute abscess procedures was established.

Method Retrospective review of Otago Surgical Audit data from 1992 to 2007 yielded clinical data for 2475 adult general surgical cases at Auckland City Hospital with a primary or secondary diagnosis of abscess. A subset of patients potentially suitable for day case surgical procedures was analysed.

Results A steady increase in numbers of abscess cases treated by the Department of General Surgery was seen from 1992 to 2007. The most common types of superficial abscess were cutaneous (47%), perianal (40%), and breast (13%). Fifty-nine percent of general surgical hospital admissions in this series could potentially have been treated on a day case basis, but only 6% were actually treated as day cases. A median duration of inpatient stay of two days was required for a mean procedure duration of 16 minutes. A total of 1357 (90%) patients had a total hospital stay of more than 24 hours in the potential day case group. This accounted for 2338 bed days over the 15-year study period, or an average of 359 bed days per annum. For the most recent three-year period, the average total cost of each acute superficial abscess admission for less than seven days was $4440. The average cost for a patient treated as a day case was $1389, indicating a potential saving of $3501 per patient if a day case service had been available.

Conclusion This study identifies a common problem which is being managed suboptimally in our hospital. Day case management of appropriate patients with acute superficial abscess would result in significant cost savings, decrease hospital bed occupancy and improve patient care.

Demand on acute operating theatres in busy hospitals means that patients with superficial acute abscesses often have to wait for many hours or days before relatively simple procedures can be performed. These patients either have procedures done late at night, after more urgent cases have been done, have to stay until the next day, with repeated periods of delay and starvation awaiting the availability of an acute theatre.

Demand on emergency departments means that these patients are admitted to a surgical ward pending treatment. Hospital bed occupancy is commonly more than 90% and patients admitted with acute minor problems often prevent elective admission of patients with major problems. Although most large hospitals have day case surgery units, there has been a tendency, at least in Auckland, for these to be on a different hospital campus from the acute services.

The Royal College of Surgeons of England, in its guidelines for day case surgery (1992), states that “day surgery is now considered the best option for 50% of all

patients undergoing elective surgical procedures".[1] Although this has not been extended to acute procedures, a number of studies have shown that certain types of abscess can be safely and successfully treated as day case procedures. These include superficial abscesses[2], pilonidal abscesses[3] and Bartholin gland abscesses[4]. Follow-up has shown good results for patients after day case surgery. Patients in these studies were generally young and otherwise healthy, and required a relatively short operating time, so a day case service for such patients appears appropriate and feasible.

There are a number of potential benefits of day case surgery for patients with a superficial acute abscess. From a healthcare perspective these benefits include decreased hospital costs, enabling dollars saved to be allocated elsewhere, reduced risk of nosocomial infection and of development of antibiotic-resistant organisms, as well as decreased risks of further infection and complications. Importantly, a day case service would relieve pressure on hospital beds.

From a patients perspective, a day case service would also decrease the amount of time patients spend away from work thereby maintaining their productivity in the community, and decrease recovery time and inconvenience to patients and their families. Previous research in this area has suggested that patients with significant but controlled systemic disease (ASA score 3—severe but not life-threatening)[5] may also be suitable for treatment as day cases[6].

The aim of this study was to review trends in the management of adult patients with acute superficial abscesses over a 15-year period at a major tertiary hospital, and to determine if significant benefits would be obtained by managing them as day cases.

Methods

Study design—Patients were identified using the Otago Surgical Audit (Otago Clinical Audit and Outcomes Unit, Dunedin, New Zealand), an electronic surgical audit system that has been used in a wide spectrum of surgical practices in Australasia, and has been described in detail elsewhere.[7–9] Data on all adult general surgical patients at Auckland City Hospital between 1992 and 2007 with a primary or secondary diagnosis coding of "abscess" were retrieved and entered into an Excel spreadsheet.

Data were screened for duplicate case records and non-abscess procedures. Of the remaining data (classified as "all cases"), a subset of patients who may potentially have been suitable for day case surgery was identified. Inclusion criteria were superficial abscesses; ASA 1 or 2; procedure length ≤60 minutes; no concomitant major procedure done in addition to abscess procedure; preoperative stay ≤5 days; postoperative stay ≤2 days.

Exclusion criteria included patient age ≤15 years); procedures that found no drainable collection, e.g. debridement alone or examination under anaesthesia alone. Patients not fulfilling all of the selection criteria for "potential day cases" were classified as "excluded cases".

In addition, patients were identified in the study data who had actually been admitted, operated on and discharged on the same date, and were classified as "actual day cases". This subset overlapped to some extent with both the "potential day cases" and "excluded cases" subsets.

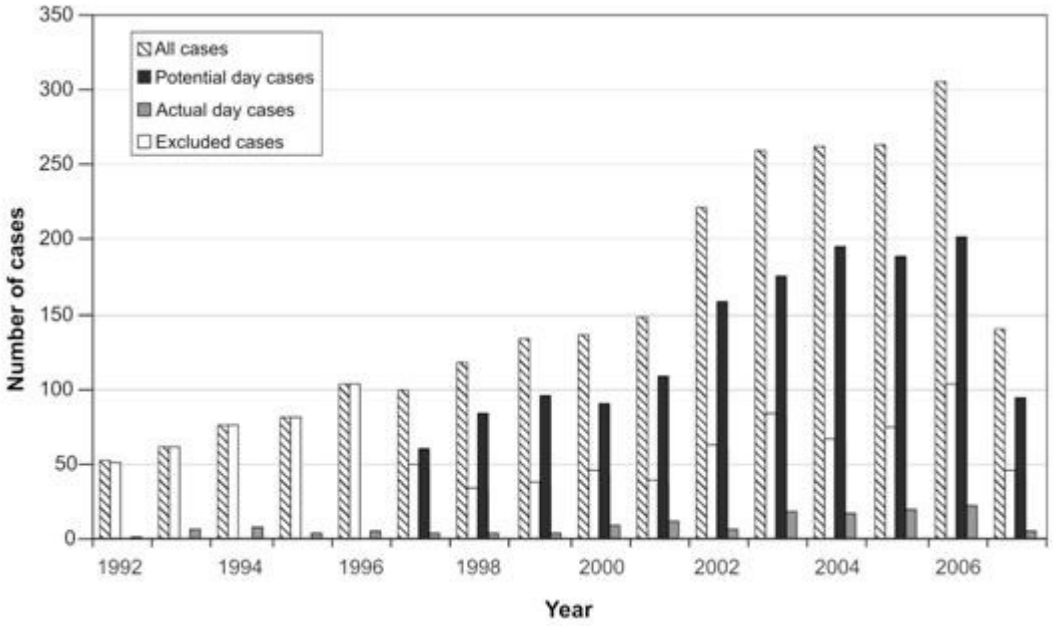
Data on these subsets were analysed with regard to median length of stay; mean duration of procedure; comparison with patients of ASA score 3 fulfilling all other criteria for a potential day case procedure; effect of surgical specialty on preoperative length of stay; trends over time in numbers of cases; trends in numbers of admissions and procedures performed on different days of the week; and types of procedures performed.

Statistical analysis—Chi-squared analysis was used to investigate for a significant difference in numbers of breast and perianal/rectal abscess cases performed by the three general surgical specialty teams.

Results

2475 patients were admitted with the diagnosis of abscess during the study period. Of these, 59% (n=1455) were classified as potential day case patients. Of the original 2475 patients, 6% (n=146) were actually treated as day cases. The annual incidence of abscess cases treated by the Department of General Surgery is shown in Figure 1 for each subgroup.

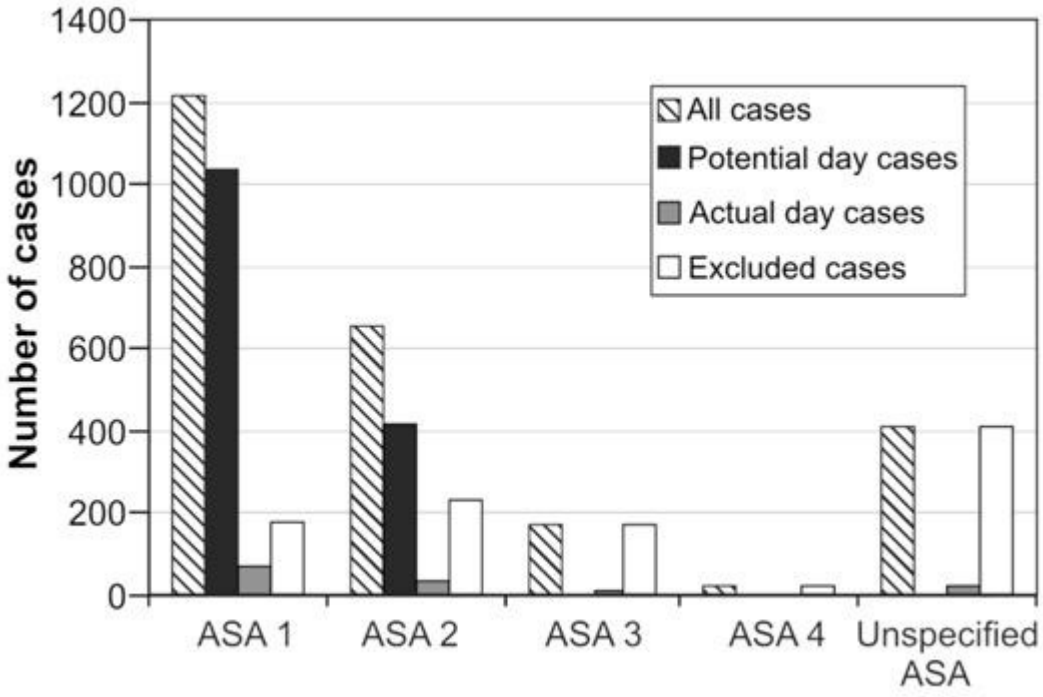
Figure 1. Annual incidence of number of admissions to the Department of General Surgery with a diagnosis of abscess from 1992 to mid-2007



The median age of patients classified as potential day cases was 33 years (range 15-88) and was not significantly different from that of patients treated as day cases (39 years, 15–83) or from that of those who were excluded as not being potentially suitable for day case surgery (40 years, 0-91). Overall there was a non-significant trend towards more males than females (1.1:1) and this was the case for each of the three categories.

Figure 2 shows the distribution of the ASA categories for the three patient groups. The potential day cases, by definition, were ASA 1 (71%) and 2 (29%).

Figure 2. Distribution of ASA categories in patients classified as potential day cases, actual day cases and excluded cases



The number and proportions of abscesses treated at each anatomical site is shown in Table 1. The mean procedure duration in the potential day case group was 16 ± 9 minutes (mean ± SD) which was not different from that for the actual day case group (18 ± 10 minutes), but both were significantly less than for the excluded cases (35 ± 46 minutes, Mann-Whitney U, two-tailed, $p < 0.0001$).

Admission of potential day case patients resulted in a median hospital stay of 2 days (range 0–7, Figure 3). The median preoperative stay was 0 days (0–5), or less than 1 day, and the median postoperative stay was 1 day (0–2). A total of 1357 (90%) patients had a total hospital stay of more than 24 hours in the potential day case group. This accounted for 2338 bed days over the 15-year study period, or an average of 359 bed days per annum.

The influence of development of specialist teams within the Department of General Surgery on the management of abscesses at different sites was examined. Table 2 shows that there was a significant trend (Chi-squared 45.5, $p<0.001$) towards breast abscess patients being managed by the Breast and Endocrine Team and perianal abscesses being managed by the Colorectal Team. Management by a specialist team had no noticeable effect on the length of preoperative hospital stay.

Table 1. Anatomical site, number of patients, type of surgical procedure, and duration of treatment for different types of abscess

Site	Treatment	Number	Duration of treatment (minutes) (Mean ± SD)
Breast	I & D alone	137	17 ± 8
	I & D ± other*	36	15 ± 9
	E & D alone	7	30 ± 15
	E & D ± other*	3	33 ± 25
	Aspiration	1	5
Perianal/rectal	EUA ± other**	1	8
	I & D alone	423	15 ± 9
	I & D ± other**	126	20 ± 9
	E & D alone	23	17 ± 9
	E & D ± other**	1	30
Cutaneous	Laying open***	7	25 ± 9
Buttock	E & D	4	13 ± 5
	I & D ± other*	119	13 ± 8
Trunk	E & D	13	20 ± 9
	I & D ± other*	99	15 ± 10
Limbs	E & D	3	10 ± 5
	I & D ± other*	152	13 ± 6
Other (single)	E & D	9	25 ± 15
	I & D ± other*	239	14 ± 9
Other (multiple)	E & D	2	20 ± 0
	I & D ± other*	44	19 ± 10
Wound abscess	I & D ± other*	6	16 ± 7

I & D = incision and drainage, E & D = excision and drainage, EUA = examination under anaesthesia; *I includes biopsy, curettage, debridement, washout ; ** includes insertion of drain/Malecot, insertion of Seton, proctoscopy/sigmoidoscopy, ultrasonography, biopsy, curettage, debridement, washout, banding of haemorrhoids; *** includes fistula operation.

Table 2. Management of breast and perianal abscesses by three specialist teams within the Department of General Surgery (3 × 2 Chi-squared 45.5, p<0.001)

Type of abscess	Colorectal Team	Upper GI Team	Breast & Endocrine Team
Breast	48	43	93
Perianal	256	169	152

Influence of day of the week on numbers of admissions and procedures was also examined. Overall, there was a decrease in the numbers of admissions and procedures from Monday to Sunday. Figure 4 demonstrates that there was not a consistent match between the number of admissions and procedures performed on a day to day basis. On Monday and Friday, the number of admissions exceeded the number of procedures. The number of procedures exceeded admissions on Wednesday, Thursday, and Saturday.

Figure 3. Frequency distribution of preoperative, postoperative, and total hospital stay for potential day case patients

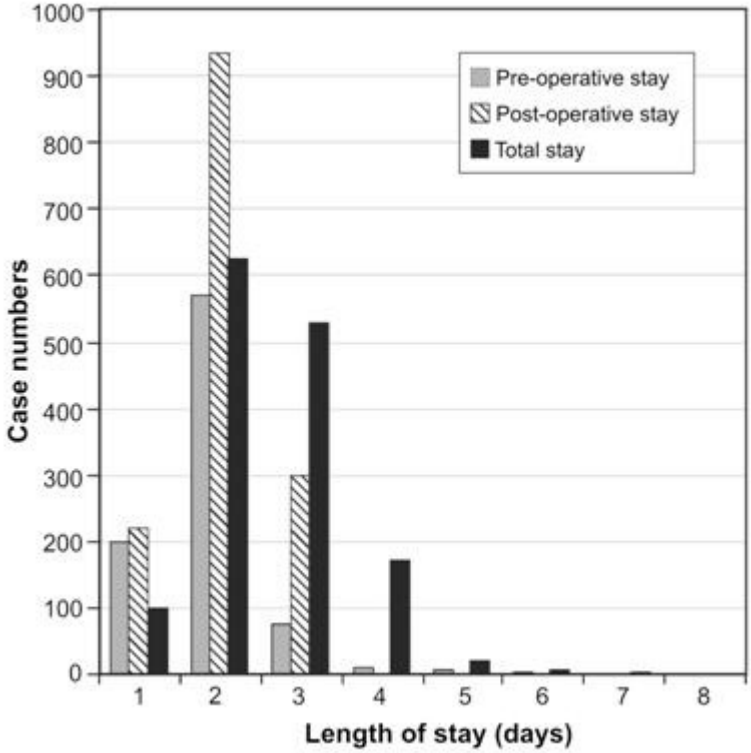
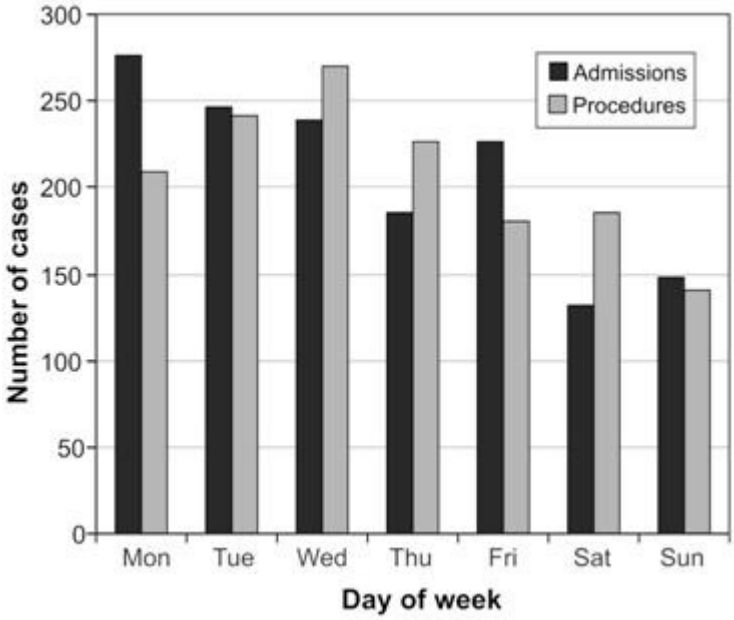


Figure 4. Number of admissions and number of procedures for each day of the week (pooled study data)



Discussion

These findings indicate that of all the patients with superficial acute abscesses admitted under general surgery, 59% could have been managed as day cases without requiring hospital admission. This relatively large group of patients, on average, spent 2 days in hospital awaiting a surgical procedure that took a mean duration of 16 minutes. The suitability of these patients for day case procedures is supported by the similarity of their demographic characteristics and procedure durations to those of actual day cases over the study period.

Finance Department records from Auckland City Hospital indicate that for the most recent 3-year period each superficial acute abscess admission for less than 7 days incurred an average cost of $4440. The average cost incurred by a patient with superficial abscess cases that was performed as a day case was $1389. This indicates a potential saving of $3051 per patient if a day case service was provided for suitable patients.

In 2006 there were 202 admissions of potential day case patients with superficial abscess. It is therefore estimated that a potential saving of $616,302 could have been made during 2006. Significant savings can also be estimated on the basis of hospital bed occupancy. For example, in 2006, approximately 404 days of hospital stay (202 potential day cases × average 2 days' stay) could have been saved if an appropriate day case service were available. In view of the anticipated increase in numbers of superficial abscess patients in the future, provision of a day case service could translate into even greater healthcare cost savings in terms of hospital stay.

Our results show an increasing number of total and potential day case abscess patients being admitted to hospital under general surgery from 1992 to 2006. There are several possible explanations for the observed rise. It might be due to increasing compliance with registration of abscess cases in the Otago Surgical Audit database over time.

It was noted that very few potential day cases were recorded from 1992 to 1996, which may reflect registration of only non-superficial abscess types in this time period. The increase might also result from fewer abscesses being managed in the community by general practitioners and by staff in the Emergency Department. At least part of the increase is likely to arise from a real increase in the incidence of abscesses in the general population.

Irrespective of the explanation, this study suggests that there will be an increasing number of abscess case admissions in the future, potentially exceeding available healthcare resources. This alone would be a compelling reason for provision of a day case service for the management of patients with superficial acute abscess.

It is not difficult to envisage what would be required to provide a day case service for the management of superficial acute abscesses. The initial treatment of these could be done "at the front door" in an Emergency Department treatment room, in a procedure room associated with an acute admissions ward, or in a theatre associated with an on-site day case surgical facility. The introduction of such a service is not complicated, but would require a culture change and the availability of a surgical registrar. If a general anaesthetic were required, then this might still be possible in a day case

facility. Patients could be discharged for review the following day, at the time of the post-acute ward round.

A previous study showed no difference in complication rates between patients with ASA score 3 and those with ASA 1 and 2 undergoing day case surgery[6]. In Natof's 10-year prospective study of 13,433 patients at a freestanding ambulatory centre in the US, 403 patients were classified according to ASA score. These included patients with hypertension, history of coronary occlusion, rheumatic valvular heart disease, asthma, chronic pulmonary disease and diabetes mellitus. There were three complications in the ASA 3 patients, and there was no statistical difference in complication rate between these patients and ASA 1 and 2 patients.

No significant differences were observed in mean procedure duration or median preoperative and postoperative hospital stay between patients with ASA score of 3 (severe but not life-threatening systemic disease) and patients with ASA 1 and 2 who were deemed suitable for day case procedures. Unfortunately no data on complication rates in these groups were available for comparison. The lack of a significant difference in duration of postoperative hospital stay between the groups[6,10] supports the theory that some patients with uncomplicated controlled systemic disease could be candidates for day case surgery. Indeed, a number of ASA 3 patients (n=12) had actually undergone day case procedures over the study period.

If patients with uncomplicated controlled systemic disease were considered potentially appropriate candidates for day case surgery, it is expected that they would be assessed on a case by case basis with regard to age, comorbidities, anaesthetic risk, expected duration and complexity of their procedure and estimated probability of postoperative complications[11]. It would not be necessary to consider ASA 3 patients for day case management to achieve significant savings, and this might be considered as a second stage in the introduction of such a service.

The three specialised general surgical teams at Auckland City Hospital rotate admitting days on an equal basis, and would be expected to admit similar numbers of patients with each type of abscess. The admitting team might hand over particular types of abscess to a specialist team to do the procedure. It is standard policy for such handovers to be made the morning following admission, although in practice this may sometimes be done on the same day. The effect of handover to a specialist team was apparent in this study.

Significantly more perianal and rectal abscess procedures were performed by the colorectal team, and significantly more breast abscesses by the head and neck/breast/endocrine team. It was expected that the handover process would result in a longer preoperative stay for these types of abscess when the surgical procedure was performed by the corresponding specialist team. However there was no difference in preoperative stay between patients with perianal/rectal abscesses and those with breast abscesses under the specialist teams.

Although there were more potential day case admissions on Mondays which generally tapered over the remainder of the week, a mid-week spike was seen for numbers of procedures performed. Numbers of admissions and procedures were almost equal on Sundays. This suggests that patients admitted on Mondays are more likely not to have a procedure until the following day or two days later. A trend was seen of more

admissions on weekdays for the potential day case group. This is surprising, because it was expected that patients would be more likely to present to hospital in the weekends when the majority would not be working and most general practices are closed, or at least that similar numbers of patients would present on weekends and weekdays.

Possible explanations for this trend may be that either more abscess procedures are performed by ED staff or there is a true increased rate of patient admission on weekdays. Unfortunately, no complete dataset was available for analysis from the Auckland City Hospital Emergency Department on their abscess admissions and procedures.

A limitation of this study is that it was a retrospective audit of a surgical database and is therefore prone to input bias. It is unlikely that all abscess procedures undertaken over the study period were included. Also, there was increased compliance with the registration of cases over the study period. Another limitation is that there are no reliable data on complication rates.

Further research might include a prospective study of ASA 3 patients compared with ASA 1 and 2 patients regarding management and outcome of those treated as day cases. It would also be useful to do a community-wide study to look at the management of superficial acute abscesses in all settings, including self-care, family practices, private accident and emergency facilities, public emergency departments, existing day case facilities, as well as inpatient care.

Conclusion

This study is important because it highlights a common and increasing problem that is being managed inefficiently. The day case treatment of appropriate patients with superficial acute abscesses has the potential to save expenditure, release hospital beds and improve the overall care of patients.

Competing interests: None known.

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Honey in the treatment of burns: a systematic review and meta-analysis of its efficacy

Meme Wijesinghe, Mark Weatherall, Kyle Perrin, Richard Beasley

Abstract

Aim To determine the efficacy of honey in burn wound management.

Methods A systematic review and meta-analysis of randomised controlled trials which compared the efficacy of honey with a comparator dressing treatment in the management of burns. The main outcome measure was the proportion of subjects with wounds healed at 15 days.

Results Eight studies with 624 subjects were included in the meta-analysis. The quality of the studies was poor with each study having a Jadad score of 1. Six studies were undertaken by the same investigator. In most studies unprocessed honey covered by sterile gauze was compared with silver sulphadiazine-impregnated gauze. The fixed effects odds ratio for healing at 15 days was 6.1 (95% CI 3.7 to 9.9) in favour of honey having a superior effect. The random effects pooled odds ratio was 6.7 (95% CI 2.8 to 15.8) in favour of honey treatment. The secondary outcome variables all showed significantly greater efficacy for honey treatment.

Conclusion Available evidence indicates markedly greater efficacy of honey compared with alternative dressing treatments for superficial or partial thickness burns, although the limitations of the studies included in the meta-analysis restrict the clinical application of these findings. Further studies are urgently required to determine the role of honey in the management of superficial or partial thickness burns.

There has long been interest in honey's medicinal uses, but despite its use as a traditional remedy for burns and wounds, the potential for its inclusion in mainstream medical care has not been well recognised.

Honey has a number of properties which make it appropriate as a wound dressing. Firstly it has been shown in *in vitro* studies to have antibacterial properties.[1–5] This is thought to be due to the presence of hydrogen peroxide which is released by the action of peroxidase, an enzyme that is added by bees to the nectar they collect.[6]

Honey also contains additional bactericidal agents which are plant derived chemicals such as bioflavinoids. The antibacterial properties of honey vary according to its source and are often high in New Zealand's manuka honey derived from the *Leptospernum* species.[7] As well as the major-wound infecting bacteria, honey has also been shown to have significant antibacterial activity against resistant gram-positive cocci such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE).[5]

Secondly, the physical barrier it forms on the wound surface due to its high viscosity prevents bacterial penetration and colonisation which is helped by the low pH (3.6) of honey.[8] It also provides a non-adherent interface between the dressing and wound bed, which creates a moist healing environment, thus preventing newly formed tissue from tearing when the dressing is removed. In addition, honey has been reported to

have deodorising properties[9,10] which have been shown to control the malodour from wounds infected with anaerobes.

A small number of clinical case studies have shown its effectiveness in the treatment of a wide range of wounds other than burns.[8,11–13] The objective of our study was to review the clinical evidence of the efficacy of honey in burns wound management. A systematic review and meta-analysis of all randomised controlled trials that compared the efficacy of honey with a comparator dressing treatment in the management of burns in humans was undertaken.

Methods

Search strategy—A search of studies containing the key words 'honey' or 'burns' was conducted from Medline, Cochrane Database of Systematic reviews, Cochrane Central Register of Controlled Trials, EMBASE and CINHAL to February 2007. The reference lists of all relevant studies were also examined. The flow of studies found by the search strategy, as recommended by the QUOROM statement, is shown in Figure 1. The trial quality was assessed using the standard Jadad score[14] based on the adequacy of randomisation, blinding, and follow up, with the maximum score of 5 points.

Inclusion criteria—To be included in the meta-analysis, studies had to be randomised, controlled, clinical trials that compared honey with a comparator dressing treatment in the management of burns. Two researchers independently examined each paper for inclusion. Studies were required to report the proportion of subjects in whom wound healing occurred at defined time points.

Exclusion criteria—*In vitro* studies, animal studies, non-randomised controlled trials, duplicate reports, reviews and studies where honey was used for a clinical indication other than burns were all excluded.

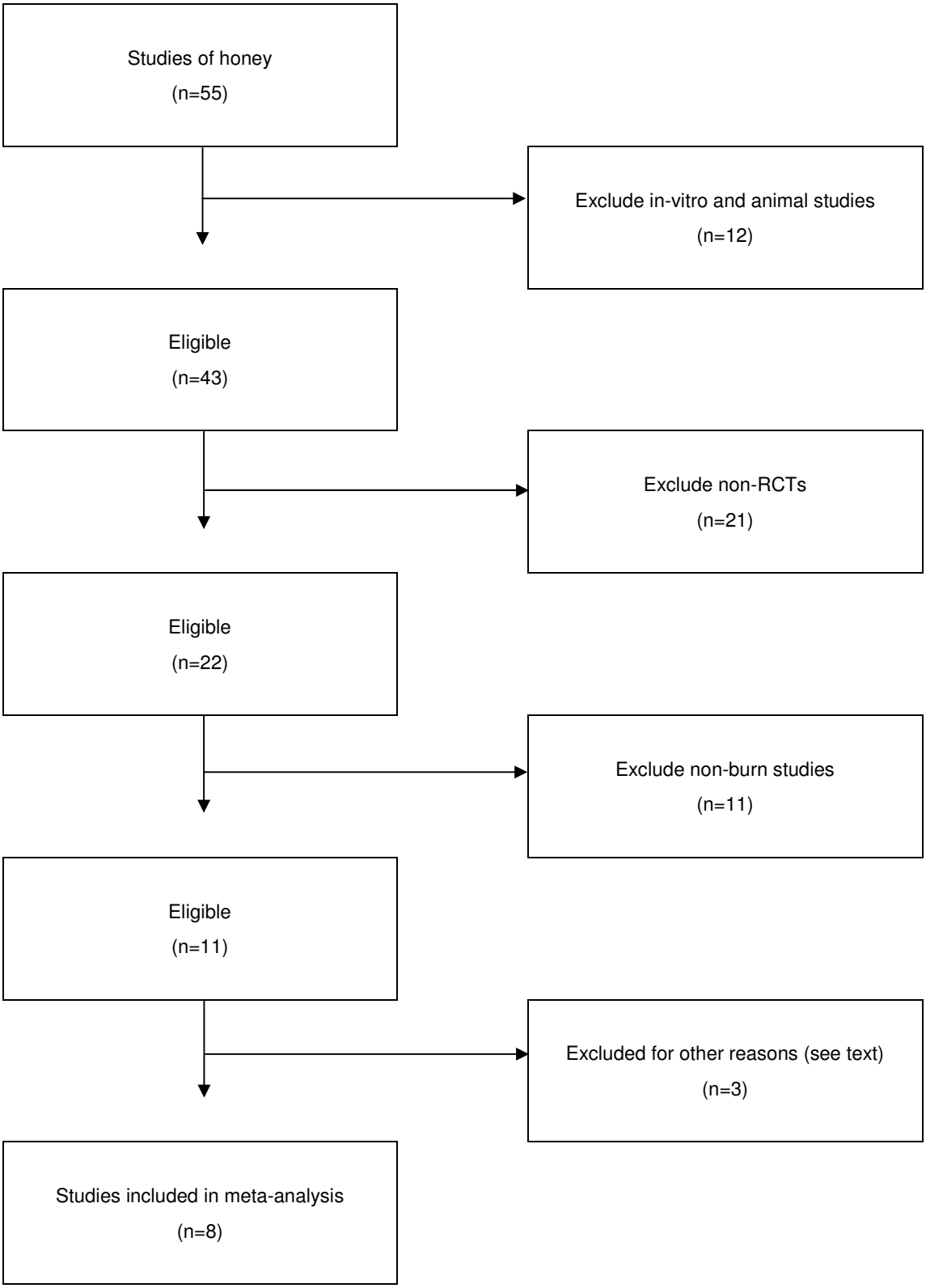
Outcome measures—The primary outcome variable was the proportion of subjects with wounds healed at 15 days. The secondary outcome variables were the number of sterile swabs at 7 days, 21-day wound healing, presence of hypergranulation tissue and formation of contractures. In order to include data on sterile swabs at 7 days, the study needed to state when the swabs were taken, the number of patients swabbed and the number of swabs taken from each patient.

The proportion of patients with wounds healed at 15 days in trials in which silver sulphadiazine was the comparator treatment was another secondary outcome variable.

Statistical methods—The categorical variables were pooled using the inverse variance weighting method for odds ratios.[15] Where a zero cell count was found 0.5 was added to each cell in the analysis. Homogeneity statistics and the I-squared statistic were calculated for each analysis.[16] Where the homogeneity statistic was significant, pooled fixed and random effects estimates are presented.

Publication bias was examined through funnel plots and formal tests of publication bias. Forest plots show the individual trial estimates as well as pooled estimates with the size of the boxes on the forest plots inversely proportional to the size of the variance of the study estimates.

Figure 1. QUOROM statement



Results

Selected studies

Eight studies with a total of 624 subjects met the inclusion criteria for the analysis(Table 1).[17–24] Six of the eight studies were performed by the same researcher in India.[18–22,24] In most studies, unprocessed honey was applied to the wound, covered by sterile gauze and changed every one to 2 days.

Silver sulphadiazine-impregnated gauze was the most common comparator treatment used. Other conventional comparator treatments included bio-occlusive moisture permeable polyurethane dressing (OpSite). Non-conventional comparator dressings included autoclaved potato peel bandages and amniotic membrane. In the studies, the burns were either partial thickness or superficial, covering <30 or 40% of the total body surface area.

Three major clinical studies were excluded. One study which compared honey dressings with early tangential excision and skin grafting was excluded as it used a non-dressing comparator treatment.[25] The second study reported non-standardised outcomes that could not be used in the meta-analysis.[26] The other study[27] which reported the outcomes in 900 patients with partial thickness burns randomised to honey or a conventional dressing, was not included as it appeared to be a duplicate publication. In this study the researcher, patient group, hospital, and time period in which the patients were recruited were the same as that reported in other clinical studies[18,21,22] included in the meta-analysis.

Study quality

The methodological quality of all the studies was poor achieving a Jadad score of only 1 for each study. Common features of the studies were: no description of the randomisation procedure, no pre-defined primary outcomes, no sample size calculations, and no evidence of whether assessment of the wounds was blinded to treatment allocation. In addition none of the studies described flow of participants through each stage or discussed if there were any subjects who withdrew.

Primary outcome:15-day healing rates

The proportion of subjects healed at Day 15 in the honey and control treatment groups in each of the six studies that reported the primary outcome variable are shown in Table 2. The pooled fixed effects odds ratio was 6.1 (95% CI 3.7 to 9.9) in favour of honey having superior efficacy. For this analysis the homogeneity test statistic was 14.7 on 5 df, P=0.01, I-squared 66.1 (95% CI 18.9 to 85.8) and so the random effects pooled odds ratio was also calculated (OR 6.7, 95% CI 2.8 to 15.8). There was no evidence of publication bias on Funnel plot or formal tests. A Forest plot of the results is presented in Figure 2.

Table 1. The characteristics of the studies included in the meta-analysis

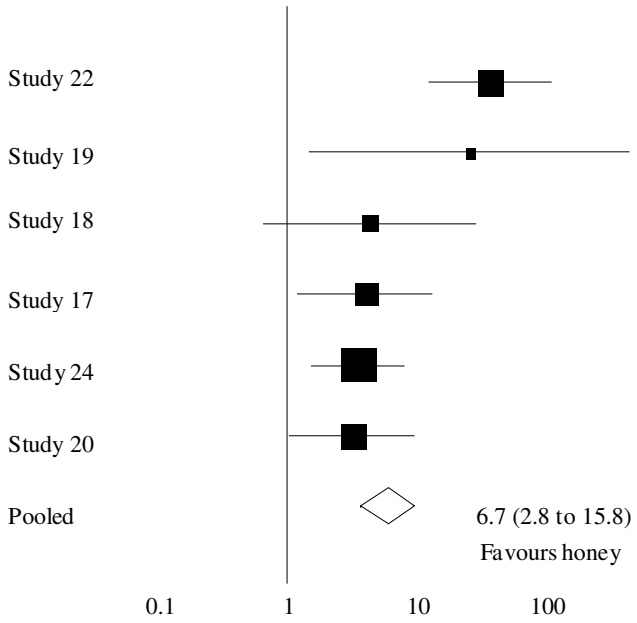
First Author	Total Subjects	Burn Type	Honey	Control
Mashhood[17]	50	Superficial and deep partial thickness burns TBSA <15%	Undiluted, applied once daily and covered with sterile gauze	1% silver sulfadiazine applied once daily
Subrahmanyam[18]	50	Superficial burns TBSA <40%	Unprocessed, undiluted applied in quantities of 16-30ml on alternate days. Covered in sterile gauze.	Silver sulfadiazine impregnated gauze replaced daily
Subrahmanyam[19]	100	Partial thickness burns TBSA <40%	Unprocessed, undiluted applied in quantities of 15-30ml on alternate days. Covered in sterile gauze.	Autoclaved potato peel bandages, replaced every 2 days
Subrahmanyam[20]	64	Partial thickness burns TBSA <40%	Honey impregnated gauze, covered with absorbent dressing, inspected every 2 days	Amniotic membrane obtained in a fresh condition. Changed on day 8, then every 2nd day
Subrahmanyam[21]	92	Partial thickness burns TBSA <40%	Honey impregnated gauze, changed every 2 days	Bio-occlusive, moisture-permeable, polyurethane dressing (OpSite). Inspected on day 8
Subrahmanyam[22]	104	Superficial burns TBSA <40%	Unprocessed, undiluted applied in quantities of 15–30 ml, daily. Covered in sterile gauze.	Silver sulfadiazine impregnated gauze replaced daily
Bangroo[23]	64	Superficial burns TBSA <15% (children)	Details not given	Silver sulfadiazine (details not given)
Subrahmanyam[24]	100	TBSA <40%	Unprocessed, undiluted applied in quantities of 15–30 ml	Silver Sulfadiazine impregnated gauze replaced alternate days

† TBSA: total body surface area.

Table 2. The number (%) of subjects healed at Day 15 in the honey and control treatment groups and corresponding odds ratios

Study	Honey	Control	Odds ratio for healing honey vs control (95% CI)
	Healed n/N (%)		
17	13/25 (52)	5/25 (20)	4.0 (1.2 to 13.6)
18	24/25 (96)	20/25 (80)	4.4 (0.7 to 29.3)
19	50/50 (100)	40/50 (80)	26.2 (1.5 to 460.4)
20	33/40 (82.5)	14/24 (58.3)	3.2 (1.1 to 9.9)
22	45/55 (81.8)	5/52 (9.6)	37.4 (12.4 to 113.4)
24	37/50 (74)	22/50 (44)	3.5 (1.5 to 8.1)
Pooled fixed effects			6.1 (3.7 to 9.9)
Pooled random effects			6.7 (2.8 to 15.8)

Figure 2. Forest plot for 15-day healing: odds ratio (on log scale) versus study, size of box inversely proportional to the variance of the estimate



Secondary outcomes

Sterile at 7 days—Despite 7 of the 8 studies reporting data on bacterial culture swabs, usable information was presented in only one study.[21] This study reported on each patient at the time of admission and on Day 8. The results show that by Day 8, 38/46 (83%) patients had sterile swabs in the honey group compared with 29 /46 (63 %) patients in the control (OpSite) group, giving a relative risk of 1.3 (95% CI 1.0 to 1.7).

21-day healing rates—In the five studies which provided data on the proportion of subjects healed at Day 21, honey resulted in significantly greater healing rates than control treatment with a pooled fixed effects odds ratio of 12.6 (95% CI 5.1 to 31.4) (Table 3). The homogeneity test statistic was 7.5 on 4df P=0.10, I-squared 46.8 (95% CI 0.0 to 80.5). The pooled random effects odds ratio was 12.0 (95% CI 3.2 to 44.4). There was no evidence of publication bias on Funnel plot or formal tests. A Forest plot of the results is presented in Figure 3.

Contractures—There were five studies which presented data on contractures (Table 4). There was a significant reduction in the presence of contractures with honey treatment, with a fixed effects pooled odds ratio of 0.4 (95% CI 0.1 to 1.0). The homogeneity test statistic was 3.1 on 4df, P=0.55, I-squared 0.0 (95% CI 0.0 to 72.9). The random effects pooled odds ratio was 0.4 (95% CI 0.1 to 1.0). There was no evidence of publication bias on Funnel plot or formal tests. A Forest plot of the results is presented in Figure 4.

Table 3. The number (%) of subjects healed at Day 21 in the honey and control treatment groups, and corresponding odds ratios

Study	Honey	Control	Odds ratio for healing honey vs control (95% CI)
	Healed n/N (%)		
18	25/25 (100)	21/25 (84)	10.7 (0.5 to 209.7)
19	50/50 (100)	50/50 (100)	1.0 (0.02 to 51.4)
20	38/40 (95)	20/24 (83)	3.4 (0.7 to 17.4)
22	50/52 (96)	22/52 (42)	27.4 (6.9 to 109.0)
24	50/50 (100)	24/50 (48)	109.2 (6.4 to 1868.3)
Pooled fixed effects			12.6 (5.1 to 31.4)
Pooled random effects			12.0 (3.2 to 44.4)

Figure 3. Forest plot for 21-day healing: odds ratio (on log scale) versus study, size of box inversely proportional to the variance of the estimate

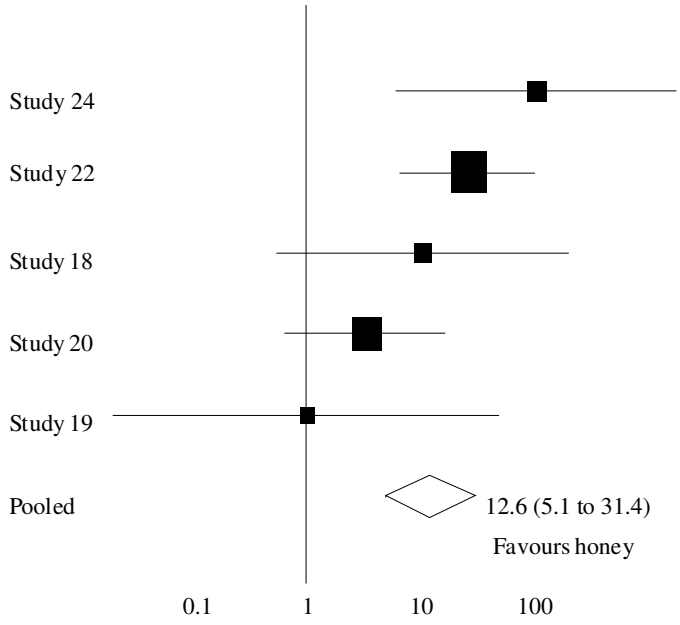
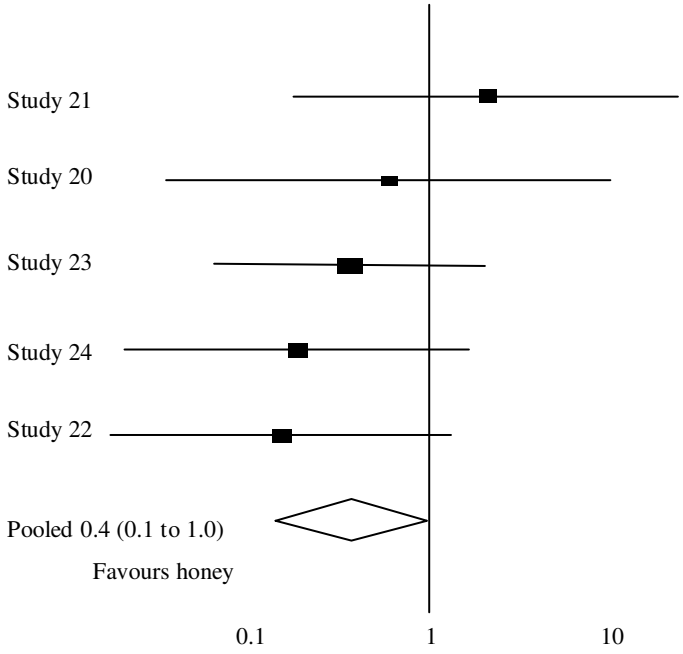


Table 4. The number (%) of subjects with contractures in the honey and control treatment groups, and corresponding odds ratios

Study	Honey	Control	Odds ratio for contractures honey vs control (95% CI)
	Contracture present n/N (%)		
20	1/40 (2.5)	1/24 (4.2)	0.6 (0.04 to 9.9)
21	2/46 (4.3)	1/46 (2.2)	2.1 (0.2 to 23.4)
22	1/52 (1.9)	6/52 (11.5)	0.2 (0.02 to 1.3)
23	2/32 (6.3)	5/32 (15.6)	0.4 (0.06 to 2.0)
24	1/50 (2.0)	5/50 (10.0)	0.2 (0.02 to 1.6)
Pooled fixed effects			0.4 (0.1 to 1.0)
Pooled random effects			0.4 (0.1 to 1.0)

Figure 4. Forest plot for presence of contractures: odds ratio (on log scale) versus study, size of box inversely proportional to the variance of the estimate



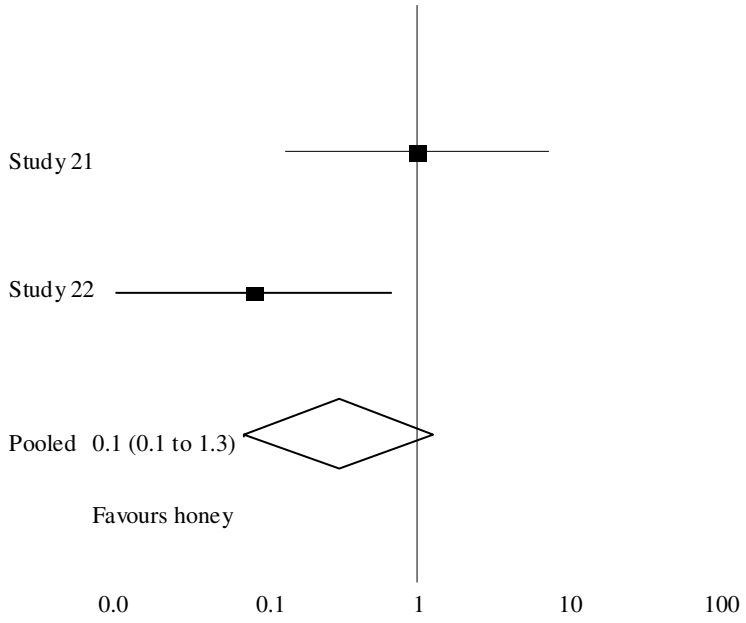
Hypergranulation tissue formation—The proportion with hypergranulation tissue formation was presented in two studies (Table 5).[21,22] The reduction in hypergranulation tissue formation associated with honey treatment was not significant with a fixed effects pooled odds ratio of 0.3 (95% CI 0.1 to 1.3). The homogeneity test statistic was 2.9 on 1df, P=0.09, I-squared 64.9 (95% CI 0.0 to 92.0). The random effects pooled odds ratio was 0.3 (95% CI 0.04 to 2.2). There was no evidence of publication bias on Funnel plot or formal tests. A Forest plot of the results is presented in Figure 5.

15-day healing rate in silver sulphadiazine comparator studies—When the analysis for the primary outcome variable was restricted to the four studies in which silver sulphadiazine was the comparator treatment[17,18,22,24] the pooled fixed effect odds ratio was 7.2 (95% CI 4.1 to 12.9) in favour of honey having superior efficacy. For this analysis the homogeneity test statistic was 12.3 on 3df, P=0.01, I-squared 75.7 (95% CI 32.9 to 91.2) and so the random effects pooled odds ratio was calculated (OR 8.0, 95% CI 2.6 to 25.0).

Table 5. The number (%) of subjects with hypergranulation tissue in the honey and control treatment groups, and corresponding odds ratios

Study	Honey	Control	Odds ratio for hyper-granulation tissue honey vs control (95% CI)
	Hypergranulation present n/N (%)		
21	2/46 (4.3)	2/46 (4.3)	1.0 (0.1 to 7.4)
22	1/52 (1.9)	10/52 (19.0)	0.1 (0.01 to 0.7)
Pooled fixed effects			0.3 (0.1 to 1.3)
Pooled random effects			0.3 (0.04 to 2.2)

Figure 5. Forest plot for presence of hypergranulation tissue: odds ratio (on log scale) versus study, size of box inversely proportional to the variance of the estimate



Discussion

This meta-analysis provides evidence that honey used in the treatment of superficial and partial thickness burns produces significantly more healing at 15 and 21 days than alternative dressing treatments and reduces the formation of hypergranulation tissue and contractures. In addition, one study showed a higher conversion rate of a positive bacterial swab to be rendered sterile at 7 days with honey treatment.

However, there are a number of major limitations of this meta-analysis and as a result, the findings must be interpreted with caution.

The study reports were generally of poor quality with Jadad scores of 1/5 for all eight studies included in the meta-analysis. The sample sizes in each study were similar but there was no mention of sample size calculations. There was no description of flow of participants through each stage. The reporting of adverse events was variable in the studies included in the analysis and there was no reporting of drop-outs. There was also no clearly defined primary outcome measure in any of the studies.

Of the results on sterility of swabs at 7 days it was only possible to use the results from one study[21] as there was no indication when the swabs were taken, the proportion of patients swabbed or the number of swabs per patient in the remainder of studies. It would have been informative for mean healing times to have been reported as an outcome variable, but this was not possible as no standard deviations were presented in each paper.

The other major limitation of this meta-analysis is that the same researcher undertook six of the eight studies in the same institution, utilising a similar design. The studies had nearly identical eligibility criteria and subjects were recruited in a congruous manner with the treatments administered in a similar fashion. Although this makes the studies comparable, it raises concerns over the generalisability of the results. Although there were 624 patients included in this systematic review, the patient population demographics and the local environment are likely to influence the results.

Comparisons with the unconventional treatments such as potato peel dressings or amniotic membranes may be inappropriate and not applicable to western medicine. Moreover that management of burns in countries such as India and Pakistan where all these studies were conducted, is largely conservative due to a relative lack of surgical burns facilities further suggesting that these findings are not generalisable to Australasia where surgical intervention is recommended at a much earlier stage. However, the majority of the studies used silver sulphadiazine-impregnated gauze as the control treatment, which has been the standard treatment of burns in western countries but is more commonly used in combination with chlorhexidine.[28]

Furthermore, when the analysis of the primary outcome variable (15-day healing rate) was limited to studies which used silver sulphadiazine as the comparator treatment, the magnitude of the increased risk was maintained. This indicated that the overall increased risk was not preferentially influenced by the unconventional comparator treatments.

As with all burns studies, randomisation of patients is a major problem as they are a heterogeneous group and the results will be predominantly determined by the extent of the thermal injury rather than the type of dressing. Although none of the studies blinded the treatment to the patient or the investigator, this would not have been possible, due to the viscosity and sweet smell of the honey, and the obvious nature of the control treatments such as silver or OpSite dressings, or the unconventional potato or amniotic membrane applications.

Notwithstanding the limitations of the studies included in the meta-analysis, the magnitude of the greater efficacy of honey treatment was striking. There was a six-fold greater healing rate at Day 15, increasing to a 12-fold greater healing rate at Day

21. There was an associated 0.4-fold reduced risk of contractures and a 70% reduction in hypergranulation tissue formation. The single study reporting adequate microbiology data observed a 30% greater conversion of positive to negative bacterial cultures in the honey group compared with OpSite.

The demonstration of efficacy of honey in the treatment of superficial and partial thickness burns in this meta-analysis is consistent with its demonstrated efficacy in healing wounds of other causes.[8,11,29,30] This property has been attributed not only to its antibacterial activity,[1,5,7,12] but also to its anti-inflammatory properties,[31,32] and hyperosmolar and deodorizing properties[9,10] Honey also fulfils many of the essential and desirable criteria for a good wound dressing in that it maintains a moist wound environment with a low level of bacterial contamination, it contours easily and is simple to apply and is cost-effective.

In summary, this systematic review and meta-analysis provides evidence for the efficacy of honey in the treatment of superficial and partial thickness burns. However, the apparent low scientific quality of the clinical trials included in the meta-analysis limits the clinical application of these findings.

In view of the magnitude of the greater benefit of honey compared with other dressings routinely used in burn wound management, further research is urgently required. This will require multiple well-designed randomised controlled clinical trials with comparison against routinely used treatments in different patient groups.

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Who do you want to treat your varicose veins?

David R Lewis

Abstract

The management of varicose veins is evolving at pace but the speed of change often outstrips the evidence. Patients should expect to be offered the whole range of treatment options that are suitable for their particular circumstances. This range should include conservative management, surgery, endovenous ablation techniques, and ultrasound guided sclerotherapy. If all the options are not discussed, patients should ask why.

Strangle, strip, grill, or poison were options given for the treatment of varicose veins in one recently published review.[1] These actions also reflect the consequences of many territorial disputes or "turf wars". The management of superficial venous incompetence is controversial not only because the treatment options are evolving at a pace that exceeds the evidence, or because our understanding of venous pathophysiology is still incomplete but also because many interventions for varicose veins are performed outside the public sector with inherent conflicts of interest.

This viewpoint article aims to summarise and compare the treatment options commonly available for varicose veins in New Zealand and asks the question; if you had varicose veins who would you like to advise you regarding what is the best treatment?

Varicose veins and the complications of chronic venous insufficiency have been recognised and treated by surgeons since before the Byzantine era and the methods employed remained largely unchanged and unchallenged until the 16th Century.[2] In modern public hospital systems in New Zealand and abroad the vast majority of patients assessed for treatment of superficial venous incompetence are seen by vascular surgeons or surgeons with a declared interest in vascular surgery. This situation is no accident nor is it an accident that much of the data published on the management of venous disease emanates from such practitioners.

The technical skill required for accurate, safe dissection of the saphenofemoral or saphenopopliteal junction,[3] the evolving evidence and revolving argument about what constitutes the optimum surgical strategy[4] and uncertainty about the significance of perforator[5] and deep vein incompetence[6] means that surgeons giving advice about what treatment is best for their patients have to keep their knowledge and skills up to date.

The same is true for doctors without specialist vascular surgical qualifications who choose to consult and treat patients with varicose veins. In countries with more fertile medicolegal soil varicose vein interventions are the most common medicolegal claims settled.[7]

In New Zealand patients have the right to be provided with the necessary information to understand the potential risks, benefits and alternative treatment options for any proposed procedure.[8] When it comes to treatment of varicose veins one size does not fit all and patients, doctors, proceduralists and insurers need to be cognisant of this fact.

When considering which treatment option is best many of us overlook conservative or non-interventional methods. It has been recognised that patients with varicose veins often present because they are worried about how their varicose veins or potential complications of venous insufficiency may progress in the future. Such fears can frequently be allayed with appropriate reassurance.[9]

Class 2 support stockings will afford symptomatic relief, improve haemodynamics and reduce swelling but many patients are not compliant with support hosiery.[10] Advice about regular exercise is probably sensible but is not supported by any evidence. For people who are obese, weight loss may reduce symptoms and might make planned intervention easier and safer.[11]

The use of sclerotherapy techniques to treat reticular varicosities and telangiectasia is established. The use of sclerosants to treat significant superficial venous reflux fell out of favour in the 1970s because of high failure rates however, sclerotherapy has undergone a resurgence in recent years following published case series using foam sclerosants (instead of liquid), injected under duplex guidance.

This technique, sometimes referred to as ultrasound guided sclerotherapy (UGS), has been suggested to be more economical than other varicose vein interventions[12] but must be performed by or with the cooperation of a skilled sonographer. There is an agreed lack of good scientific data comparing the outcome of foam sclerotherapy in terms of quality of life, recurrence, cosmesis and symptomatic relief with other treatments.[11,12]

One of the few published comparisons of foam sclerotherapy with surgery (and concomitant sclerotherapy) showed a high level of persistent reflux in the group of patients treated with sclerotherapy alone.[13] Even with the use of foam and ultrasound guidance repeated treatment sessions may be required[10,11] and high recurrence rates have been documented on duplex follow up.[14]

Sclerotherapy has surprisingly been reported to have potentially significant complications, apart from the well documented local reactions and risk of deep vein thrombosis, including the passage of sclerosant to the circulation of the eye or brain through a patent foramen ovale.[15] It is not cost-effective to screen all potential UGS patients for this common cardiac anomaly. UGS does appear to be a useful adjunct to the endovenous techniques described below.

Minimally invasive techniques for the abolition of superficial venous reflux include radiofrequency ablation and endovenous laser therapy (EVLT). Both techniques can be performed under tumescent local anaesthesia and involve cannulation of the saphenous trunk with subsequent treatment applied down the length of the truncal vein.

The laser technique works by a process of endothelial damage, focal coagulative necrosis, shrinkage and thrombotic occlusion of the vein[16] while radiofrequency ablation results in endothelial denudation, collagen denaturation and acute vein constriction.[17] Reviews of the literature regarding both techniques[10–12,18] and one subsequent randomised trial[19] suggest that EVLT and radiofrequency ablation allow patients to return to normal activities more quickly than following conventional surgery but in the medium to long-term surgery and endovenous techniques are

similar in terms of improvements in quality of life, complications and recurrent varicose veins.

Varicose vein surgery and EVLT also take the same time to perform.[19] Like UGS these endovenous techniques require a skilled and credentialed sonographer to ensure their safety and efficacy. EVLT takes less time than radiofrequency ablation and might have a lower rate of complications such as deep vein thrombosis and thermal injury to nerves or skin but well designed and appropriately powered studies with adequate follow up are needed to clarify this and other suppositions.

Superficial venous surgery, usually in the form of saphenofemoral ligation with stripping of the greater saphenous vein to the knee and phlebectomies remains the "gold standard" against which newer techniques must prove themselves.[10] Such varicose vein operations have been shown to be both clinically and cost effective[7,21] and remain the only proven intervention that helps reduce recurrent venous ulceration.[6]

Refinements in surgical and anaesthetic techniques mean that many patients, even with bilateral varicose veins, can be treated as day cases although general anaesthetic is still usually required. Further refinements in technique may reduce but do not eliminate post operative bruising and discomfort. Return to normal activities is usually slower following surgery when compared with less invasive treatments. Recurrence of varicose veins following surgery is a well published[21,22] and publicised fact but is no more frequent than recurrence following other varicose vein interventions.[10,11]

Careful consideration of the current published data concerning the treatment of patients with varicose veins confirms that any single intervention is not suitable for all patients. Not all treatments are currently available within the financial constraints of the New Zealand public health system but patients should be fully informed about all the treatment options available to them in both public and private practice. Endoluminal therapy is currently being trialled at some public hospitals in New Zealand and in all likelihood will become established.

Paternalistic advice to patients, based on anecdotal experience or limited interpretation of the literature, can only be avoided by clinical review with a doctor who is experienced at such patient focused assessments[23] and who can tailor and provide the whole range of treatment options; UGS, endovenous ablation and surgery. Patients have the right to this information. Who do you want to treat your varicose veins?

Competing interests: David Lewis is a specialist vascular surgeon at Christchurch Public Hospital, a senior lecturer at The University of Otago, and a director of Christchurch Vascular Group which is a specialist vascular surgical private practice.

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THE NEW ZEALAND MEDICAL JOURNAL
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Blue fingers and lips on an acute medical take

Syed Raza, Asis Kumar

Cyanosis has a wide range of differential diagnoses. It is, however, very rare that the obvious cause is not very apparent. We report an interesting case report where this was not the case.

Case report

A 19-year-old previously fit and healthy English student was admitted to our acute medical admission unit in the early hours of the morning with blue fingers and lips.

He had been drinking alcohol (Guinness and Lager) in the pub the previous night when he developed some mild abdominal discomfort and his friend shortly noted his fingers and lips turning blue. The patient denied any other symptoms. He also denied taking any recreational drugs and also denied the possibility of his drinks being spiked.

Physical examination on arrival was unremarkable except for bluish lips and fingers. His oxygen saturation on air was 97%. Laboratory investigations including full blood count, renal function, and liver function clotting were normal. Serum paracetamol and salicylate levels were normal and so were the initial poison screen. Serum ethyl alcohol was within normal limit. Chest X-ray and electrocardiogram did not show any abnormality. Initial arterial blood gas analysis (on air) showed the following: pH—7.30; pO_2—11.9; pCO_2, HCO_3—24.3; BE—0.1, lactate—1.4, SPO_2—97%.

However a repeat arterial blood gas analysis on a more advanced machine in addition to the above also showed carboxy haemoglobin at 0.1% and methhaemoglobin at 18.9%.

A diagnosis of methhaemoglobinaemia was therefore made with no known apparent aetiology but it was suspected that the patient's drink may have been spiked with amyl nitrite, more commonly known as 'poppers'. His case was discussed with the National Poison Centre and conservative management was advised. A repeat arterial blood gas analysis 8 hours after admission showed a significant drop in the methhaemoglobin level to 1.5% by when his fingers and lips regained normal colour.

He was subsequently discharged home.

Discussion

Amyl nitrite ('poppers') is one of the commonest substances that is misused in clubs, bars, and sex shops.[1] Methhaemoglobinaemia is an important cause for peripheral and central cyanosis despite normal oxygen saturation. Prompt recognition of the same is important as failure to treat patients with severe methhaemoglobinaemia on time may be catastrophic. There are various causes such as nitrates or amyl nitrite that may precipitate methhaemoglobinaemia.

Intravenous methylene blue infusion is used for treatment of patients with severe methhaemoglobinaemia (MetHb of more than 40%, symptomatic).[2] Asymptomatic patients with MetHb level of less than 20% does not require any treatment and such patients may be discharged after a period of observation.

Learning points:

- Methhaemoglobinaemia is a rare cause of cyanosis
- Oxygen saturation is normal
- Precipitating cause needs to be identified
- Methylene blue should be avoided in patients with G6PD deficiency
- Underlying haemolysis should be ruled out

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Acute exercise-induced compartment syndrome of the leg: an Auckland series

Phillip Insull, Simon Young

Compartment syndrome is a pathological process characterised by increased pressure within an enclosed fascial envelope, compromising compartment perfusion and oxygenation.[1] This has classically been divided into two distinct entities, acute compartment syndrome (ACS) where a specific event causes increased pressure leading to tissue damage and a further rise in pressure, and chronic exertional or 'exercise induced' compartment syndrome, where increased compartment pressure occurring during exercise causes pain which is relieved by rest.[2]

We describe a series of patients in which exercise was the precipitating event in the development of an acute compartment syndrome in patients with no prior history of chronic symptoms. Prompt recognition of the condition in the primary care setting is essential to successful definitive management.

Acute exercise-induced compartment syndrome (AECS) of the leg is defined as:

> An acute compartment syndrome arising in the leg in the complete absence of any trauma or surgery, in individuals without pre-existing risk factors for the development of the condition (Such as a chronic exertional compartment syndrome and blood dyscrasias), following athletic activity.

Cases

Case 1—A 38-year-old male with no known medical comorbidities. No regular participation in regular athletic activity. The patient presented to hospital the morning after a 15 km walk home from a social function, while intoxicated the previous night. He complained of severe bilateral anterior and lateral leg pain which was unrelenting over several hours.

The on-call orthopaedic registrar made a provisional diagnosis of acute compartment syndrome and compartmental manometry was performed. Elevated pressures were measured in the anterolateral compartments of both legs. The patient was urgently taken to the operating theatre where selective fasciotomies were performed.

On the right leg the extensor hallucis longus was found to be poorly perfused, but contractile. Peroneus longus and brevis were both poorly perfused and non-contractile. However, at the conclusion of the procedure all muscles appeared well perfused, but peroneus longus and brevis remained non-contractile. As intraoperative posterior compartmental manometry was normal, no posterior compartmental releases were made.

On the left leg the anterior compartment musculature looked poorly perfused and tibialis anterior and extensor digitorum longus were only faintly contractile. Extensor hallucis longus was non-contractile. The lateral compartment musculature was also poorly perfused and non-contractile. Again, perfusion improved in both muscular compartments following release, but there was no discernable improvement in

contractility. Posterior compartment manometry was also performed intra-operatively on the right side and found to be normal and not released.

Forty-eight hours later the patient was taken back to the operating theatre for planned exploration and debridement of any non-viable musculature. Unfortunately extensive muscular necrosis was noted throughout the previously released compartments on both legs. No contractility was evident. Aggressive debridement was performed, resulting in complete excision of the peroneii on the right and significant muscle loss throughout all involved compartments.

This gentleman has gone on to develop ongoing disability with foot drop affecting the left leg and bilateral impairment of power of dorsiflexion with altered sensation in the distribution of the superficial peroneal nerve bilaterally.

Case 2—A 26-year-old female with insulin dependant diabetes. No regular sports or exercise activities. The patient developed unrelenting right lateral pain after her first training run on a treadmill. Over the next few days she visited her GP several times complaining of leg pain, then eventually self-presented to the emergency department five days after its onset. She was found to have tense right anterior and lateral compartments.

Compartment manometry revealed elevated anterolateral pressures prompting urgent operative decompression of her anterior and lateral compartments. Her anterior compartment musculature was found to be well perfused and contractile. Peroneus longus and brevis were found to be frankly necrotic and were debrided to bleeding tissue.

Over the two subsequent days the patient returned to theatre for serial wound irrigation and debridement. Four days later the patient's wounds were closed with split skin grafts. The patient was observed on the ward with prophylactic antibiotics and physiotherapy for a further 5 days. The patient had complete loss of active movement in ankle and toe extension.

Unfortunately the patient represented 2 weeks later with a methicillin-resistant *Staphyloccus aureus* wound infection, thus was admitted and treated with intravenous clindamycin. Her power of dorsiflexion had improved and was scored as 2/5 at that time.

In subsequent follow-up outpatient clinic appointments gradual recovery in tibialis anterior power was noted and was 3/5 when last assessed. The patient remains unable to extend her toes or evert her foot actively.

Case 3—A 24-year-old female with no known medical comorbidities. The patient was an occasional social netball participant. She presented to the emergency department 3 days after a match with extreme left leg pain and tightness. One day prior to being seen in ED, she had visited her general practitioner who prescribed analgesia. On examination she was found to have tense left anterior and lateral compartments and gross impairment of the musculature of these compartments.

In the operating theatre the anterior and lateral compartments were released revealing a relatively normal anterior compartment. The lateral compartment musculature appeared poorly perfused and was non-contractile. The muscles were preserved and wounds left open, for a planned second-look procedure 48 hours later. At that time the

peroneal musculature looked well perfused proximally, yet was still not contractile. The distal half of the musculature appeared necrotic and did not bleed. The anterior compartment was found to contain pink and contractile muscle bellies. The decision was made to not perform any muscular debridement at that stage.

Four days later the patient returned to theatre where approximately 20% of peroneus longus and brevis were necrotic at the musculotendinous junction and were non-contractile throughout their length. The non-viable tissue was excised and the wounds were closed.

Again, this patient has been left with permanent disability in eversion of the left foot and impairment in her ability to participate in athletics.

Discussion

'Volkmann's ischaemic contracture' was described in 1881,[3] however it was not until the 1970s that the pathogensis of acute compartment syndrome was understood.[4] A 'viscous cycle' (Figure 1) of increased compartment pressure leading to tissue damage and a further increase in pressure, most commonly in the lower leg compartments following trauma, such as tibial fracture.[5] Numerous other causes of acute compartment syndrome have been described, including: muscle rupture; vascular injury; crush injuries, and burns.

Prior to this, in 1957, Blandy reported on a group of patients with a condition he termed 'March Gangrene', occurring in military conscripts undergoing rigorous training.[6] He described the onset of escalating pain following exercise, with tense, swollen compartments and findings of ischaemic myonecrosis on histology. This description matches the clinical scenario seen in our series of patients, unconditioned patients performing exercise outside their usual activity level.

In contrast, chronic exertional compartment syndrome occurs in athletes during normal training and is relieved by rest.[7] During exercise, muscle volume can increase by more than 20%[8] in part due to increased blood flow, and this coupled with physiological muscular hypertrophy in predisposed athletes with fascial tightness leads to increased compartment pressures and subsequent pain.[9] This is distinct from the pathogenesis of acute compartment syndrome, as cessation of exercise with onset of pain leads to a reduction in muscle volume and compartment pressure, so the 'viscous cycle' is averted.

Previous reports of acute exercise-induced compartment syndrome in the literature are summarised in Table 1. These cases share the precipitating factor of strenuous or unaccustomed exercise in the absence of chronic symptoms and were often accompanied, as in our series, by a delay to diagnosis. Such delays may be due to the rarity of this condition. Delay to fasciotomy has been associated with poorer long term functional outcomes in acute compartment syndromes.[10]

Table 1. Previous modern case reports of AACS of the leg (meeting our definition)

Author	Age Sex	Presentation	Diagnosis missed by doctor in the community?	Time to fasciotomy from onset of symptoms (approximate)	Procedure(s)	Outcomes
Anderson KD Am J Emerg Med 2005[11]	19 Male	Unilateral anterolateral leg pain and deep peroneal nerve paraestheisa Insult: Running (army training run)	Yes, day one after onset of pain	72 hours	Four compartment fasciotomy and muscle debridement	Permanent foot drop and deep peroneal paresthesia
Esmail AN Am J Sports Med 2001[12]	17 Male	Unilateral anterior-lateral leg pain and deep peroneal nerve paraesthesia Insult: Football training and place-kicking practice	Yes, day one after onset of pain	72 hours	Anterolateral muscular excision and limited muscular excision	Near full functional recovery, persistent deep peroneal paraesthesia
Cara JA SICOT 1999[13]	30 Female	Unilateral posterior leg pain Insult: 10-hour walk while in psychotic state	Not seen in community prior to admission	12 hours	Four compartment fasciotomy	Paresis of peronei (power 3/5) at 2 years
Koka SR Injury 1998[14]	17 Male	Unilateral anterolateral leg pain Insult: Strenuous basketball training	Yes, day one after onset of pain	48 hours	Anterolateral compartment decompression and complete muscle excision	Foot drop requiring orthosis
Stollsteimer GT J Athl Train 1997[15]	18 Male	Unilateral anterolateral leg pain and deep peroneal nerve paraesthesia Myoglobinuria Insult: Early (football) season training run	Yes, day one after pain (also seen by team physiotherapist)	96 hours	Anterolateral compartment fasciotomy and partial muscular excision	Persistent paralysis of peronei
McKee MD Am J Ortho 1995[16]	24 Male	Bilateral anterolateral leg pain Insult: Vigorous uphill walk	Not seen in the community prior to admission	3 hours	Bilateral anterolateral fasciotomies	Full functional recovery at six months
Willy C Int J Sports Med 1995[17]	20 Male	Anterolateral leg pain Insult: Soccer match	Not seen in the community prior to admission	13 hours	Anterolateral fasciotomy	Anterior tibial pain and early fatigue at six months
McHale KM Orthopaedic review 1994[18]	30 Male	Anterior leg pain Acute tubular necrosis Insult: Running (army physical fitness test)	Yes, day one after onset of pain	144 hours	Anterolateral fascotomy and muscle debridement	Poor functional recovery with inability to extend great toe and weakness in ankle dosiflexion

Diagnosis of acute compartment syndrome—Prompt recognition of the clinical features of acute compartment syndrome, often combined with compartmental manometry is vital to making the diagnosis expeditiously.[19] Pain is arguably the most vital symptom to suggest the diagnosis. Severe pain, often out of proportion with the injury, or pain with passive stretching of intra-compartmental musculature (stretching fingers/toes), are both very sensitive findings. Later signs include: distal pareasthesiae; extremity pallor; reduced distal pulses; distal paralysis. One should not wait for these later signs prior to raising concerns and further investigation or management.

Compartmental manometry can be a useful adjunct to the clinical diagnosis of acute compartment syndrome.[20] Various different commercially available systems exist. Commonly saline is injected into each compartment in the limb of interest, through a pressure transducer, and the pressure required for flow is measured and converted to a reading in millimeters of mercury (mmHg). When fracture is present, the needle should be directed as close to the fracture site as possible to record peak pressures.

Various threshold pressures have been proposed in the literature for fasciotomy. An absolute threshold of 30mmHg[21] and a difference of less than 30 mmHg between diastolic blood pressure (DBP) and intra-compartmental pressure (ICP) are both commonly used in clinical practice (DBP minus ICP).[22] The diagnosis should not be excluded in the presence of a clinical examination suggestive of acute compartment syndrome with normal ICP measurements.

Conclusion—Acute exercise-induced compartment syndrome of the leg is a rare complication of strenuous athletic activity. If diagnosis is delayed patients may suffer permanent injury and disability. The only treatment for acute exercise-induced compartment syndrome is urgent decompressive fasciotomy.

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THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

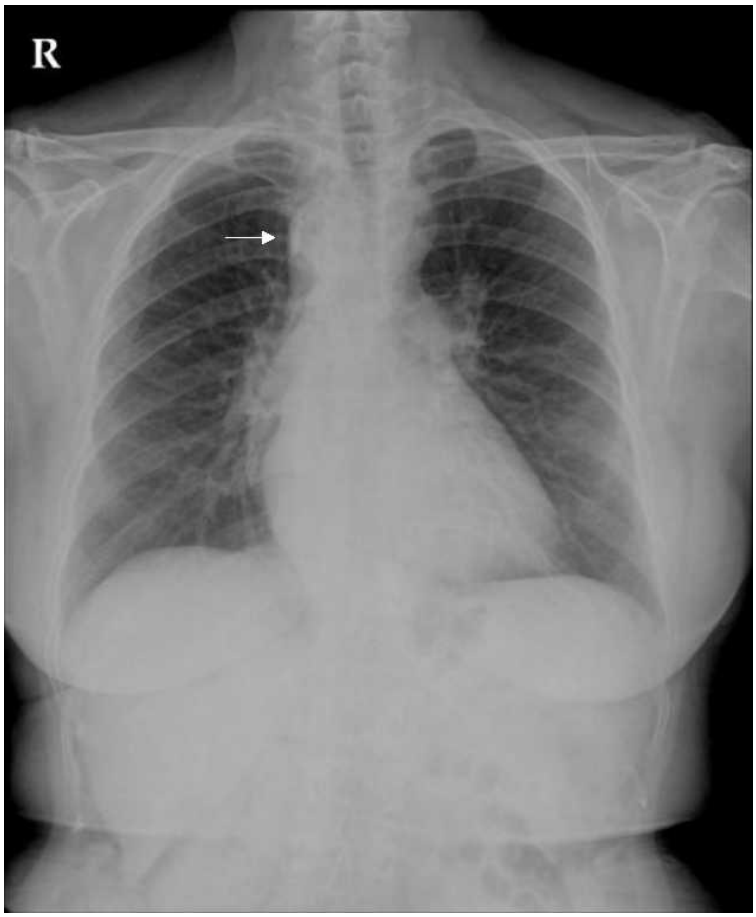
A case of Kommerell

Wan-Hsiu Liao, Sheng-Hsiang Lin, Tsu-Tuan Wu

Clinical

A 67-year-old woman was referred to our hospital because of an abnormal chest radiograph. Her physical examination was normal. Posteroanterior chest radiograph demonstrated an opacity in the right upper mediastinum (Figure 1).

Figure 1. Chest radiograph showing an abnormality in the right upper mediastinum (arrow) and left deviation of the lower trachea

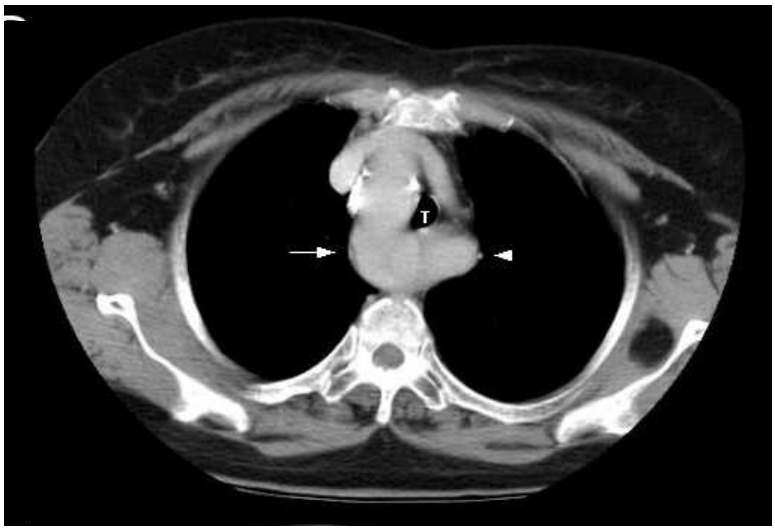


What is the normal variant shown?

Answer

Contrast-enhanced chest computed tomography (Figure 2) revealed a right-sided aortic arch associated with an aberrant left subclavian artery originating from the Kommerell's diverticulum. The trachea was displaced to the left of the midline and the oesophagus was pushed forward. The thoracic descending aorta was situated near the midline and then descended on the right. A transthoracic echocardiogram showed no evidence of congenital heart anomaly or patent ductus arteriosus.

Figure 2. Chest computed tomography with contrast at the level of the aortic arch, showing a right-sided aortic arch (arrow) with Kommerell's diverticulum (arrow head) surrounding the trachea



Discussion

Right-sided aortic arch is a rare congenital defect of the aorta. Edwards has described three main types of right-sided aortic arch.[1] Type I patients have a right-sided aortic arch with mirror image arch branches. The presenting case with aberrant left subclavian artery would be classified as a Type II arch. Type III arches have an isolated left subclavian artery. The presenting case remained asymptomatic in spite of the presence of tracheal and oesophageal compression.

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THE NEW ZEALAND MEDICAL JOURNAL
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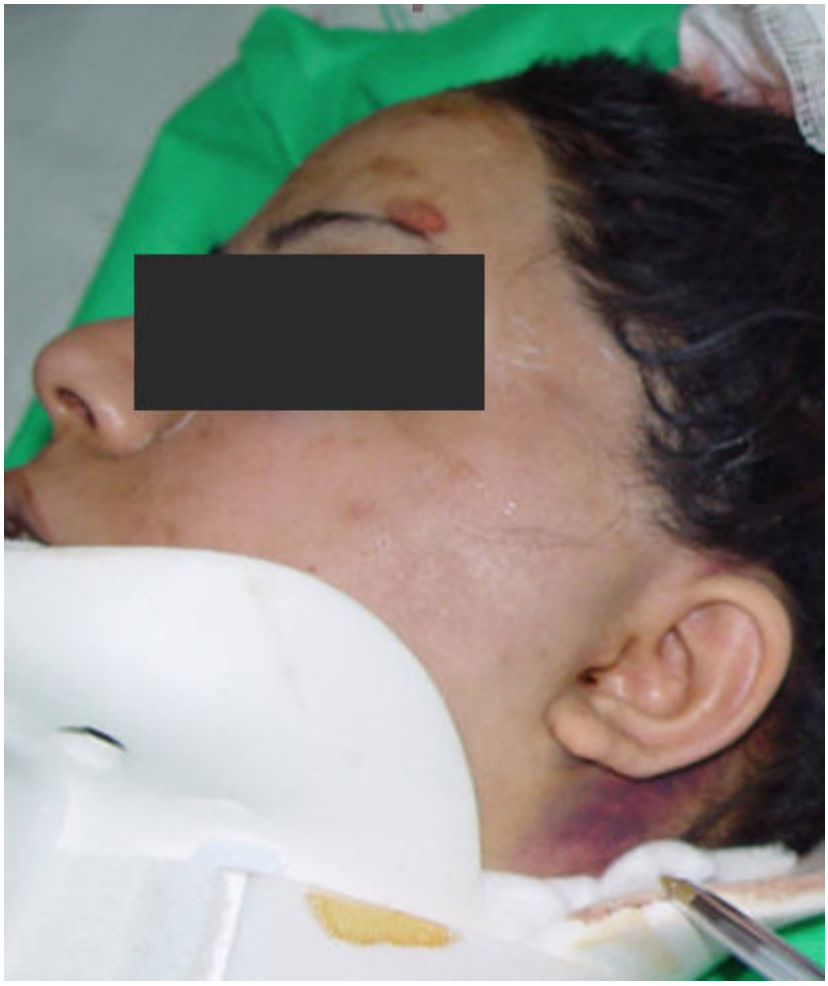
Battle's sign

Hossein Sanaei-Zadeh, Kamran Aghakhani

Clinical

A 25-year-old woman presented to the emergency department (ED) after a severe blunt head injury. X-rays of the skull were unremarkable. After 12 hours, a gross Battle's sign was observed (Figure 1).

Figure 1. Haematoma behind the ear, Battle's sign (mastoid ecchymosis)



What is the significance of this finding?

Answer

Haematoma behind the ear, also known as Battle's sign (mastoid ecchymosis), is a *clinical indicator of a base of skull fracture*.

This sign is named after Dr William Henry Battle, an English surgeon.[1] Computed tomography (CT) of the brain showed an extensive base of skull fracture extending into the left temporal bone.

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THE NEW ZEALAND MEDICAL JOURNAL
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Some exploded theories and forgotten remedies in medicine: part 4 (epilepsy)

Published in NZMJ 1909;7(29):51– and written by Dr De Lisle, District Health Officer for Hawke's Bay. Read before the Annual Meeting of the B.M.A., Napier.

Continued from part 3 at http://www.nzma.org.nz/journal/122-1294/3586

There were many theories extant as to the cause of epilepsy. That the seat of the disease was situated in the medulla oblongata. That it was due to perverted functions of the sexual organs, pointing to castration in men and clitoridectomy in women as the treatment, have all been exploded.

We do not profess to know the cause now; all that we know of the disease now is that we can recognise it, sometimes benefit it, more often not, but we do not know the cause of it.

The disease was well known to the ancients. The Greeks treated epileptics with special respect, and we find the disease described in the New Testament, Luke x, 38-42.

Professor Trousseau, of Paris, spoke favourably of the use of belladonna in epilepsy, but I have never read or heard of anyone else having observed good results from the use of this drug in the treatment of this complaint. I think it may be classed amongst the forgotten remedies.

Dr. Elliotson and some of his followers asserted that good effects in the treatment of epilepsy were obtained by mesmerism. One old practitioner with whom I was acquainted, informed me that he had cured cases of epilepsy by means of mesmerism, but found that the remedy had a more disastrous effect on the intellect than the disease. He, therefore, discontinued it.

That two diseases cannot exist at the same time in the same body, is, I think, an exploded theory. Yet there are some facts which appear to support it. Phthisis is frequently arrested during pregnancy, and in the disease we have just been considering, epilepsy, it is a well observed fact that during the course of an acute illness, such as one of the specific fevers, epileptics are free from fits.

THE NEW ZEALAND MEDICAL JOURNAL
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Revealing the genomic secrets of the oral bacterium *Streptococcus salivarius* strain Mia.

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Streptococcus salivarius is the predominant oral bacterial species in humans and is commonly associated with good oral health. Some strains produce antimicrobial proteins (bacteriocins) and harbour large extrachromosomal DNA molecules (megaplasmids). However, the mechanisms by which *S. salivarius* colonises the oral cavity, as well as the ecological roles of bacteriocins and megaplasmids, remain largely enigmatic. The aims of this study were to completely sequence and annotate the genome of *S. salivarius* Mia, which produces at least three bacteriocins targeting oral pathogens and harbours a 180-kilobasepair megaplasmid.

Randomly-sheared *S. salivarius* Mia genomic fragments were sequenced using the high-throughput Genome Sequencer FLX System. Nearly 43 million basepairs of sequence data were assembled into 149 contiguous sequences (contigs), which were then sorted into 88 and 34 chromosome- and megaplasmid-related contigs, respectively. The remaining 27 contigs were grouped as “repetitive DNA” contigs. The gene annotation process adhered to a standard protocol comprising (i) gene prediction (GeneMark), (ii) homology searches (BLAST), and (iii) contig orientation using the genome sequences of the closely-related dairy species *Streptococcus thermophilus* as reference points. In this project, 672 predicted genes (591 chromosomal, 81 megaplasmid) were successfully assigned. Whereas the chromosomal contigs of *S. salivarius* Mia were similar in organisation to that of *S. thermophilus*, the megaplasmid-related contigs comprised a more diverse genetic collection such as three bacteriocin-associated loci, genes encoding cell surface adhesin-like proteins and gene clusters apparently acquired from other oral streptococci.

Annotation of the *S. salivarius* Mia genome thus far suggests a chromosomal “core” (similar to that of *S. thermophilus*) and an expanded (megaplasmid-borne) genetic repertoire that may provide insights into how *S. salivarius* successfully colonises the mouth. Completion of the *S. salivarius* Mia genome sequence will require extensive inter-contig gap closure procedures and annotation of all remaining predicted genes.

Western blot analysis of cannabinoid CB2 receptor expression in the rat spinal cord following induction of neuropathic pain. T Hoffman, P Brownjohn, J Ashton. Department of Pharmacology and Toxicology, Otago School of Medical Sciences, University of Otago, Dunedin.

Neuropathic pain is caused by nerve injury or dysfunction within the central or peripheral nervous systems. Inappropriate activation of these nerves can result in the development of chronic pain syndromes. Cannabinoid receptors are present in the pain pathways, and may be potential drug targets for the treatment of neuropathic pain. This study was designed to investigate the role of cannabinoid CB2 receptors in the spinal cord and changes in their expression, following induction of chronic neuropathic pain using the chronic constriction injury (CCI) model.

Eleven adult male Wistar rats (200-300 g) were subjected to either CCI or sham surgery. Animals were euthanased 10 days after surgery by decapitation following brief exposure to CO_2. Spinal cord sections at the level of the L4-L6 spinal roots were rapidly harvested and the tissue prepared for analysis by Western blot. Immunodetection for CB2 receptor protein employed a rabbit-derived antibody raised against CB2 (Cayman Chemical, USA). β-actin immunodetection was used as a loading control (Santa Cruz Biotechnology, USA). Densitometry and statistical analyses using an unpaired test were conducted on both western blots.

Results showed that there were no significant differences ($P > 0.05$) in the levels of CB2 expression in the lumbar spinal sections of the CCI-operated rats (0.15 ± 0.04) compared to the sham controls (0.13 ± 0.03). In addition, no significant differences ($P > 0.05$) were found in the levels of CB2 expression in the cervical spinal sections.

The presence of bands consistent with CB2 expression was expected as our group has previously found that CB2 selective agonists delivered to the spinal cord reverses neuropathic pain following CCI. The lack of any change in CB2 expression following CCI was unexpected. Therefore, this is inconsistent with the hypothesis that CB2 is upregulated in immune or glial cells following CCI surgery.

Novel insights into the elastic and muscular components of the human trachea. K Kamel[1], L Beckert[2], M Stringer[1]. [1]Department of Anatomy and Structural Biology, Otago School of Medical Sciences, University of Otago, Dunedin, [2]Department of Respiratory Medicine, Christchurch Public Hospital, University of Otago, Christchurch, New Zealand.

Despite its probable importance in health and disease, the elastic tissue in the trachea has rarely been investigated. In addition, various aspects of the trachealis muscle are controversial. The aim of this study was to clarify this clinically relevant anatomy.

Ten cadaver tracheobronchial specimens (age range 68-101 years; 7 males; no major airway pathology) were qualitatively and systematically investigated by detailed microdissection. Serial histological sections from multiple standard sites in three specimens were analysed after staining for elastin. Findings were correlated with observations from five video tracheobronchoscopies (age range 47-68 years; 3 males; no gross proximal airway pathology).

An extensive and prominent meshwork of elastic tissue was found within the trachea and proximal bronchi. Elastic fibres were predominantly longitudinal and aggregated into: i) discrete, finely interconnected longitudinal bundles within the posterior membranous trachea and main bronchi, becoming thinner and more circumferentially distributed within bronchi. These longitudinal bundles were clearly visualised beneath uninflamed mucosa in all tracheobronchoscopy recordings, at least to the level of subsegmental bronchi; ii) a discrete fibroelastic membrane bridging the posterior trachea external to the trachealis muscle (mean thickness 1044 ± 71 μm in subcricoid region, becoming thinner more distally); and iii) dense vertical laminae connecting the ends of successive cartilages. Trachealis consisted of a transverse layer of smooth muscle internal to the fibroelastic membrane of the posterior tracheal wall, together with scattered discontinuous longitudinal muscle bundles, mostly embedded within the fibroelastic membrane in the distal half of the trachea.

In conclusion, there is an extensive but relatively neglected elastic framework within the tracheobronchial tree. This is likely to have major clinical relevance to the pathophysiology of respiratory disease and ageing. The trachealis muscle is more complex than previously stated, which raises interesting questions about its function.

Rapid estrogen-induced cAMP-response element binding protein phosphorylation in gonadotropin-releasing hormone neurons depends on extracellular signal-regulated kinase activation *in vitro*. R Cheong, I Abraham. Centre for Neuroendocrinology and Department of Physiology, Otago School of Medical Sciences, University of Otago, Dunedin.

Estrogen action upon gonadotropin-releasing hormone (GnRH) neurons is critical for fertility. Estrogen rapidly induces cAMP-response element binding protein (CREB) phosphorylation in GnRH neurons via estrogen receptor β (ERβ). We have previously demonstrated that estrogen also rapidly increases phosphorylated extracellular signal-regulated kinase (pERK1/2) expression, upstream of CREB phosphorylation, within GnRH neurons through an ERβ dependent mechanism. In the present study, we investigated the role of the mitogen-activated protein kinase (MAPK) pathway in estrogen-induced CREB phosphorylation by selective blockade of ERK1/2 phosphorylation.

Acute brain slice preparations were made in the coronal plane from ovariectomised adult female mice. The brain slices were pre-incubated with or without 1 μM mitogen-activated extracellular signal-regulated kinase kinase (MEK) inhibitor (U0126) for 30 min before being treated with or without 100 nM 17β-estradiol (E2) in ethanol for 15 min. Those slices pretreated with U0126 also received U0126 in the incubating solution. Double-labelled peroxidase-based immunohistochemistry was performed on 30 μm coronal sections for phosphorylated CREB (pCREB) in GnRH neurons.

A quantitative GnRH neuronal count revealed that the number of GnRH neurons was not altered by E2 treatment (E2, 34.3 ± 1.1, mean ± SEM, n = 3; vehicle, 34.5 ± 0.7, n = 2). Consistent with previously described experiments, the number of GnRH neurons expressing pCREB was increased after 15 min of 100 nM E2 treatment (44.7

± 3.3%, n = 3, $P < 0.05$, two-way ANOVA) compared to vehicle treatment (26.1 ± 0.5%, n = 2). In sections pre-treated with the U0126 inhibitor, E2 treatment had no effect on CREB phosphorylation in GnRH neurons compared to vehicle (U0126 + E2, 14.1 ± 6.0%, n = 3; U0126 + vehicle, 18.2 ± 3.4%, n = 3).

Hence, our results suggest that E2-induced CREB phosphorylation within GnRH neurons may be dependent on the MAPK pathway.

Comparison of modifiable cardiovascular risk factors at diagnosis of type 2 diabetes and at 5 years between different age groups, Otago, New Zealand, 1997-2002. J (EH) Lee, K Coppell[1], S Williams[2], J Mann[1]. [1]Edgar National Centre for Diabetes Research, Department of Medical and Surgical Sciences, [2]Department of Preventive and Social Medicine, Dunedin School of Medicine, University of Otago, Dunedin.

Diabetes is a common and increasingly prevalent non-communicable disease. Assessment and treatment of known modifiable cardiovascular risk factors including blood pressure (BP) and lipid levels is an important aspect of diabetes management, but does not always happen. This study compared clinical measures and estimated cardiovascular risk at diagnosis and at 5 years for new cases of type 2 diabetes (T2DM) enrolled on the Otago Diabetes Register (ODR), 1997-2002 (n = 1,108) by age at diagnosis (<40 years, n= 57; 40-59 years, n = 406; 60-79 years, n = 594; and ≥80 years, n = 51). Demographic, medication and clinical data were extracted from the register. The New Zealand risk equation tables were used to estimate 5-year cardiovascular risk.

The youngest group had worst array of cardiovascular risk factors at diagnosis, including the highest proportion of smokers (26%), obesity (body mass index (BMI) 34.5 ± 11.2 kg m^{-2}, mean ± SD), the worst glycaemic control (glycated haemoglobin (HbA1c) 7.3 ± 1.9%) and highest triglycerides (2.6 ± 3.6mmol/L). Statistically significant changes in clinical and biochemical measures were evident at 5-years in all age groups ($P < 0.001$). Improvements in most clinical measures were greatest in the <40 year group including weight (97.7-91.0 kg, $p < 0.001$) BMI (34.5-32.2 kgm^{-2}, $p < 0.001$), systolic BP (128.4-115.8 mmHg, $p < 0.001$), diastolic BP (80.7-71.9 mmHg, $p < 0.001$) and triglycerides (2.6-1.9 mmol/l, $p < 0.001$). In contrast, glycaemic control worsened despite more intense medication with the youngest group showing the greatest deterioration in HbA1c by 0.6% ($p < 0.001$). At 5 years cardiovascular risk was almost unchanged in all age groups.

These observations demonstrate good diabetes management can result in improved modifiable cardiovascular risk factors in T2DM patients, but glycaemic control deteriorated despite intensification of hypoglycaemic medication.

Effect of food consistency in growth and morphology of the mandibular condyle. **I Mirhosseini[1], B Niven[2], R Cook[2], G Dias[1]. [1]Department of Anatomy and Structural Biology, Otago School of Medical Sciences, University of Otago, Dunedin. [2]Department of Oral Rehabilitation, Faculty of Dentistry, Dunedin.**

The morphology of the human temporamandibular joint (TMJ) varies between individuals and it is difficult to determine normal from abnormal/pathological. This study aimed to determine if the variation in the shape of the TMJ could be as a result of a natural adaptation in response to different functional loading demands.

Eight female Kuni Kuni piglets were used in this investigation. After weaning, the animals were randomly assigned into two groups of four, soft or hard diet. Each animal was given three separate doses of vital stains intravenously at set time-points during the study. At the end of the experimental period (8.5 months), the animals were killed and the TMJs were excised and histological analysis was used to measure the amount of new bone deposition in the anterior, central and posterior regions of the mandibular condyle.

The degree of new bone deposition in the hard diet group was significantly (n = 4, $P < 0.001$, paired *t*-test) higher than the soft diet group. Analysis of data showed that the majority (87%) of animals fed a hard diet tended to show greater new bone deposition on the left side when compared to the right, indicating that these animals chewed more with the left side than the right. In both groups the degree of new bone deposition was significantly ($P < 0.01$) higher in the posterior area than other regions, suggesting that new bone deposition mostly occurs in a posterior direction.

The findings of the present study indicate that the consistency of the diet plays an important role in craniofacial growth and development. Thus, altering consistency of diet could have small but significant effect on the rate of bone deposition in the mandibular condyle and in overall structure of the temporamandibular joint.

Prediction of disease outcomes using the molecular classification of joint inflammation in Rheumatoid Arthritis. **S Missen[1], J Highton[1], P Hessian[2], T Doyle[3]. [1]Department of Medical and Surgical Sciences, [2]Department of Physiology, [3]Department of Radiology, Otago School of Medical Sciences, University of Otago, Dunedin.**

Rheumatoid arthritis (RA) is a debilitating inflammatory polyarthritis. Recognition of heterogeneity within RA may allow prediction of disease outcomes, and the targeted application of modern biological treatments. Interleukin 17A (IL-17A) and a marker of follicular dendritic cells, CD-21L, are both found in the synovial membranes of patients with RA and indicate more organised joint inflammation. The present study aimed to discover if patients with synovial membranes positive for IL-17A and CD-21L have worse disease than those with negative synovial membranes.

We carried out a retrospective notes review and patient interviews on 30 patients who had undergone joint surgeries, and subsequently had their synovial membranes analysed using RT-PCR to detect the presence of IL-17A and CD-21L transcripts. Primary outcome measures were the Sharp score of radiographic damage and the modified Health Assessment Questionnaire (mHAQ) to measure disability.

We found no significant difference in disease severity between the IL-17A+/CD-21L+ and IL-17A-/CD-21L- groups (Sharp score = 10.8 ± 7.3 vs 9.1 ± 5.3, mean ± SD; mHAQ = 0.04 ± 0.04 vs 0.03 ± 0.02). However, there was an earlier average age of disease onset amongst patients with CD-21L positive synovial membranes (39.9 ± 16.8 years, P = 0.05), compared to those with CD-21L negative synovial membranes (51.2 ± 15.9 years).

In conclusion, we found no differences in disease severity in patients assessed retrospectively at a late stage of disease, but the earlier age of onset does imply differences. We plan to further investigate these differences by analysing synovial membrane characteristics in patients who have had synovial biopsies taken early in the course of their RA with clinical data collected prospectively.

The many roles of Fezf2. S Parker, S Hughes. Department of Biochemistry, Otago School of Medical Sciences, University of Otago, Dunedin.

The transcription factor, forebrain embryonic zinc finger 2 (Fezf2) functions in neuronal patterning and differentiation and is critical for the development of cortical spinal motor neurons (CSMNs). Fezf2 contains an Eh1 repressor domain, suggesting that FezF2 is likely to be a transcriptional repressor; however this activity remains to be shown in neural cells. A study using chromatin immunoprecipitation identified over 30 genes that are potentially regulated by *Fezf2*, with a number implicated in brain development. The present study proposed to determine how Fezf2 regulates expression of several of these genes; *Brain 4, Catenin Delta 2, Neuregulin-1* and *Semaphorin 5A (Sema5A)*, an axonal guidance molecule, in neural progenitor cells (NPCs).

PC12 cells, a cancer line derived from a pheochromocytoma of the rat adrenal medulla, were generated to over-express Fezf2 under the doxycycline-inducible promoter. PC12-FEZF2-IGFP and negative control PC12-IGFP cDNA was extracted and used for quantitative polymerase chain reaction (QPCR). Using SYBR Green detection of double-stranded products and analysis of data using the comparative C_t method, we found no endogenous gene expression of *Brain 4, Catenin-Delta 2* or *Neuregulin-1* in PC12 cells, and these genes were not activated by Fezf2. However, *Sema5A* expression was induced (mean 10.2 fold ± 0.3, n = 4; from 2 independent samples) in response to *Fezf2* expression, relative to the house-keeping gene glyceraldehyde-3-phosphate dehydrogenase.

Sema5A mediates release of cytokines in the periphery and is also implicated in axonal guidance during brain development. The role of Sema5A in response to Fezf2 in NPC's is unknown, but our data suggest that it will be important to study in developing CSMNs.

Sequencing and annotating the genome of the oral bacterium Streptococcus salivarius JH. A Wong[1], M Cullinan[1], J Tagg[2], N Heng[1]. [1]Department of Oral Sciences, Faculty of Dentistry, [2]Department of Microbiology and Immunology, Otago School of Medical Sciences, University of Otago, Dunedin.

Streptococcus salivarius is a gram-positive bacterium that is a pioneer coloniser of the human oral cavity and is generally associated with good oral health. However, little is known about the genetic repertoire that allows S. salivarius to be a successful oral species. The overall aim of this study was to obtain a completely-annotated genome sequence of S. salivarius JH, a strain that produces three antimicrobial (bacteriocin) types and harbours a large 220-kilobasepair extrachromosomal DNA molecule (megaplasmid).

The genome of S. salivarius JH was sequenced using the high-throughput Genome Sequencer FLX system and the data obtained (113,973 reads totalling 27.9 million basepairs) was assembled into 282 contiguous sequences (contigs). These contigs were categorised putatively as either chromosomal- (228 contigs) or megaplasmid-related (54 contigs). Annotation (gene assignment) was conducted using a combination of gene finding software (GeneMark), homology detection algorithms (BLAST) and the genome sequences of the closely-related species Streptococcus thermophilus as references. In this project, 661 predicted genes (568 chromosomal, 93 megaplasmid) were annotated. The S. salivarius JH chromosome appears similar in organisation to that of S. thermophilus including the unusual presence of six ribosomal RNA operons. Annotation of selected megaplasmid-associated contigs revealed loci for three streptococcal bacteriocins (salivaricin A2, streptococcin A-FF22 and streptin) and tetracycline resistance (transposon Tn916). Interestingly, the salivaricin A and streptococcin A-FF22 loci appear to be adjacent to each other, suggesting acquisition en bloc. Genes encoding putative adhesin-like proteins were also detected but their locations and functions remain unknown.

To date, approximately one-third of the genomic complement of S. salivarius JH has been catalogued. Completion of the S. salivarius JH genome sequence will require extensive closure of inter-contig gaps (by sequencing of gap-bridging PCR amplicons) followed by final annotation of all remaining predicted genes.

Human papillomavirus type 16 E6 protein regulates cellular β-catenin and glycogen synthase kinase-3β. YK Wong, M. Hibma. Department of Microbiology and Immunology, Otago School of Medical Sciences, University of Otago, Dunedin.

Human papillomavirus type 16 (HPV 16) is the causative agent of cervical cancer. HPV16 E6 is a potent oncoprotein that has been shown by our laboratory to down-regulate β-catenin, a protein that plays an important role in cell growth and whose deregulation results in carcinogenesis. Presenilin 1 (PS1) is a cellular protein that regulates β-catenin by interacting with gylcogen synthase kinase-3β (GSK-3β), the major kinase involved in proteosomal degradation of β-catenin. The present study investigated whether there is a decrease in PS1 resulting in increased GSK-3β-mediated proteosomal degradation of β-catenin in the presence of HPV16 E6.

Protein expression of GSK-3β, PS1 and β-catenin was compared between control and matching E6-expressing colon carcinoma (HCT116) cells, using western blot analysis then quantified using densitometric analysis. In HCT116 cells expressing E6, β-catenin was decreased by 47% (1387 ± 418 INT/mm^2, mean ± SEM, n = 4, $P < 0.05$; paired *t*-test) compared to control cells (2631 ± 661 INT/mm^2, n = 4). Additionally, total GSK-3β was reduced in HCT116 E6 cells by 40% (783 ± 338 INT/mm^2, n = 3, $P < 0.05$) compared to control cells (1317 ± 351 INT/mm^2, n = 3). Total PS1 was similar between control (546 ± 46 INT/mm^2, n = 4 $P > 0.10$) and E6 cells (462 ± 17 INT/mm^2, n = 4). Treatment with the proteosome inhibitor, MG132 led to stabilisation and restoration of β-catenin in HCT116 E6 to wild type levels but surprisingly, to a further decrease in GSK-3β expression.

Taking these results together, β-catenin degradation occurs via the proteosomal pathway. Down-regulation of β-catenin by HPV16 E6 is independent of reduced PS1 expression. Additionally, β-catenin degradation is unlikely to be via the GSK-3β pathway because the results were contrary to those expected, as stabilisation of β-catenin should result from the decreased GSK-3β expression observed.

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Asthma and the risks of long-acting beta-agonists (LABAs)

This vexing problem has once more been reviewed by the Food and Drug Administration (FDA) in the United States. They have been unable to reach a decision because of lack of data concerning the safety issue.

An editorial examines the problem. The authors point out that when LABAs are used together with inhaled corticosteroids, the combination reduces severe asthma exacerbations. No one is questioning whether these drugs provide therapeutic benefit. However, recent meta-analyses of all clinical trials comparing the effects of combined treatment with inhaled corticosteroids and LABAs with the use of inhaled corticosteroids alone have shown a small, nonsignificant increase in death from all causes among the patients receiving the combined treatment.

The editorial writers believe that the onus is on the drug makers to implement trials to settle the issue. And they conclude that "physicians should continue to use LABAs to treat asthma, but only together with inhaled corticosteroids."

New England Journal of Medicine 2009;360:1592–5 & 1671–2.

Obesity, type 2 diabetes and bariatric surgery

The authors of this paper note that the prevalence of obesity-induced type 2 diabetes mellitus is increasing worldwide. Their very large meta-analysis involves 621 studies over a 16-year period, 1990–2006. Their aim was to determine the impact of bariatric surgery on type 2 diabetes in association with the procedure performed and the weight reduction achieved. And their findings were that weight loss and diabetes resolution were greatest for patients undergoing biliopancreatic diversion/duodenal switch, followed by gastric bypass, and least for banding procedures.

Insulin levels declined significantly postoperatively, as did haemoglobin A1c and fasting glucose values. Overall, type 2 diabetes was resolved in 78% and resolved or improved in 87% of patients undergoing bariatric surgery, and the benefit was maintained at 2 years. Quite impressive , but the situation at 10 years out is awaited with interest. Healthier eating patterns in youngsters would be a preferable alternative.

The American Journal of Medicine 2009;122:248–56.

Safety and efficacy of methotrexate in the management of rheumatoid arthritis and related conditions

The authors of the paper state that methotrexate (MTX) is the most frequently used disease-modifying antirheumatic drug (DMARD) either in monotherapy or combination therapy for rheumatoid arthritis (RA). They felt it timely to review their experience with MTX in the management of RA and related conditions.

Their survey involves 790 patients (518 RA, 191 seronegative arthritis, and the balance, related conditions) over an 18-year period. The average maximum weekly dose was 17.5mg and it was well tolerated as only 93 (11.8%) of patients discontinued MTX because of adverse reactions, the majority of these being gastrointestinal problems. In only 2 cases (1 neutropenia and 1 thrombocytopenia) were there haematological problems.

Nearly half (47.5%) of the patients with RA were in remission. They conclude that MTX is safe and effective in the management of RA. Furthermore they suggest that when the dose of MTX is stabilised, blood monitoring (full blood count and liver function tests) could be done at 3 monthly intervals, rather than more frequently as currently recommended by the American College of Rheumatology (ACR).

Internal Medicine Journal 2009:39:228–36.

Vertebral compression fracture (VBF)—treatment with balloon kyphoplasty

VBFs are common in the aged because of osteoporosis. How are such fractures best treated? Surgery is reserved for the otherwise fit with neurological compromise and most with VBF have rest, analgesia, and sometimes bracing. Such conservative treatments are far from ideal. This paper reports on a randomised trial comparing balloon kyphoplasty with conservative measures.

A catheter is inserted and balloon inflation compacts the cancellous bone and pushes the endplates apart. The balloons are removed and the void is filled with viscous bone cement.

The mean functional improvement at 1 month was significantly improved ($p<0.0001$) in the kyphoplasty arm of the trial. Two serious related adverse events (haemotoma and urinary tract infection) were reported in the 138 patients who had kyphoplasty. Sounds good but obviously considerable training required for the operator.

Lancet 2009;373:1016–24.

Treatment of Bell's palsy—steroids and/or antivirals?

A question of some importance as this idiopathic facial nerve palsy is not uncommon—up to 40 per 100,000 per annum incidence—with approximately one-third left with permanent facial paralysis. In this paper, two Cochrane reviews and a recent randomised controlled trial are considered. Using preserved facial nerve function as the primary outcome demonstrates that steroids are effective—the number needed to treat (NNT) for one additional person to experience full facial function being six and eight at 3 and 9 months respectively.

The antiviral, acycolovir, confers no benefit. The authors recommend prednisolone 50mg daily (=prednisone 60mg daily) for 10 days. However they point out that treatment should start within 72 hours of diagnosis. They also commend its cheapness—in New Zealand 60mg prednisone costs 18 cents ($1.80 for 10 days).

BMJ 2009:338:410–11.

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Delays in the lung cancer pathway in South Auckland—and author response

I read with interest the recent *NZMJ* paper from Sood et al describing delays in the lung cancer pathway in South Auckland.[1] Whilst I would encourage a debate which leads to improved patient care, perhaps the conclusion is disingenuous in that "intervals for initial assessment, diagnosis and treatment of lung cancer in South Auckland *do not* meet the recommendations of international guidelines" should read "they *did not* meet the guidelines in 2004" as the paper reflects the situation 5 years ago and no effort has been made to assess current performance.

The paper also highlights the importance of support services. Although funding was transferred for frontline clinical services when lung cancer care was devolved from a central tertiary centre to Counties Manukau District Health Board (CMDHB) the resources for support services were not increased in proportion. Clinical care will continue to be compromised until the value of support services is recognised.

There is mention of a 149-day delay in performing a CT scan when an incorrect assumption was made that his bronchiectasis was responsible for haemoptysis. It is then acknowledged that the CT was requested at a later date due to subsequent chest X-ray (CXR) changes. How can an investigation be defined as delayed when it has not been requested? This inappropriate definition of a delay will undoubtedly skew the data. The authors of this paper also attribute (unspecified) delays to radiology when patients have missed appointments. It would have been more factually correct to have analysed the interval between the request being received by radiology and the first scan appointment.

There is no doubt that we must strive to improve the care of patients with lung cancer, as well as all our other patients. This paper demonstrates the need to invest in clinical support services and to ensure efficient utilisation of those resources by reducing the did not attend (DNA) rate, which is a particular problem in South Auckland.

Better collaboration between the frontline clinical teams and the support services is essential if the potentials for improvement are to be realised.

Stuart Barnard (Dr)
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Reference:

1. Sood J, Wong C, Bevan R, Veale A, Sivakumaran P. Delays in the assessment and management of primary lung cancers in South Auckland. N Z Med J. 2009;122(1294):42–50. http://www.nzma.org.nz/journal/122-1294/3580

Response

We thank Dr Barnard for his interest in our paper. We agree that we should strive to improve the care of patients with lung cancer. Our study was undertaken to identify areas for quality improvement and we openly published our data to highlight the issue of delays in the assessment and management of lung cancer patients in South Auckland.

Since 2004, a number of quality improvement initiatives have been undertaken. We now grade referrals within 2 days and request CT scans at the time of grading. Middlemore Hospital has purchased a second CT scanner. A multidisciplinary meeting has been successfully established and we have employed an oncology nurse specialist, who expedites the investigations and ensures that the results are acted on expeditiously. In addition, an Auckland lung cancer group has been formed to specifically look at improving the quality of lung cancer care in the region.

Dr Barnard states that we should have said that the intervals 'did not meet the guidelines in 2004'. The first line in our discussion states that 'The results of this study indicate that the intervals for initial assessment, diagnosis and treatment of primary lung cancer in South Auckland in 2004 did not meet the recommendations of international guidelines'.

Dr Barnard also raises issues about the patient with a 149-day interval to performing a CT scan. Our study assessed the interval from the first chest physician assessment to the time the when the CT was performed. However, we were not able to reliably assess (and did not define) an interval from the time of referral to the time of CT scan. This time interval and other time intervals within the radiology process for CT scan would be very interesting to review. For this particular patient, the CT was requested shortly after the second CXR done on 9 June 2004. The CT was done on 27 September 2004. This is a delay of approximately 3 months.

He was also concerned about outliers skewing the data. We addressed this issue by stating the median intervals and interquartile ranges.

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National Immunisation Register inaccuracies and duplications: Ministry of Health response

A letter published in the *NZMJ* on 23 January 2009 claimed that inaccuracies in the National Immunisation Register were not supporting general practices in their work and were undermining confidence in the register's effectiveness.[1]

The Ministry of Health takes these claims seriously and has investigated the records with Sue Taft, one of the letter's authors. We found that of all the claimed errors, only 1 child was unaccounted for.

There were 55 children with duplicate messages. Rather than being errors, these result from a deliberate catch-all mechanism that sends a message to each and every practitioner who has vaccinated or queried the immunisation status of a child on the register. This can be turned off if a provider no longer wants updates about specific children.

Of the 36 children included on the practice report but not on the National Immunisation Register report, 29 had never been immunised, nor had their immunisation status been queried by that practice so no association between these children and the practice had been made.

Of the remaining 7 children, 3 had more recently been immunised at other practices and another 3 were missing because the practice report and the register reports were for different timeframes, meaning records that showed up on one may not yet have shown up on the other.

Only 1 child was unaccounted for. An investigation into this case is underway.

There were 58 children included on the National Immunisation Register report but not on the practice register. Of these, 51 had presented to the practice at some time and either received immunisations or had their immunisation status queried, which created a link to the practice. When a child moves to a new practice, the register is not updated until the new practice enters an immunisation or a DHB administrator manually updates the record.

The association for the remaining 7 children was created when they were born and a parent/caregiver nominated a primary care provider. The National Immunisation Register notifies the provider, who can accept or decline the nomination. Unless the provider declines, they will continue to be associated with the child. A provider can ask a DHB Administrator to remove an association at any time.

On a positive note, the practice data showed a lower-than-average rate of 1.5% of total immunisations being declined.

The National Immunisation Register is an important tool in helping us reach 95% immunisation coverage rates. To get there, we need to ensure that every child is offered the chance to get immunised. We welcome any feedback that helps us achieve this.

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Rachel Guthrie
Team Leader
Population Event Registers
Information Directorate
Ministry of Health, Wellington

Reference:

1. Poskitt N, Taft S. National Immunisation Register inaccuracies and duplications [letter]. N Z Med J. 2009;122(1288):113. http://www.nzma.org.nz/journal/122-1288/3449

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A freely available software tool for assessing aspects of pandemic influenza risk reduction for small islands

The World Health Organization (WHO) advises against travel restrictions for pandemic influenza control.[1] Nevertheless, given historical examples of islands successfully excluding or delaying influenza in past pandemics,[2,3] we have explored this issue further.

After completing the necessary mathematical modelling work, we developed a simple simulation tool and made it freely available ("EscaVal" v1 released on 8 May 2009: http://www.influsim.info/software/escaval). This tool, with adjustable parameters, computes the probability that an isolated population escapes a major outbreak of pandemic influenza if it substantially reduces the number of arriving travellers during the whole course of the pandemic.

Travel volume reductions include the combination of voluntary reductions in travel expected during a pandemic as well as restrictions that might be imposed as a control measure. The output is presented (graphically and in a table) as the probability of escaping a major outbreak (escape probability). This probability is presented for a range of reproduction numbers (R_0) from 1.0 to 3.5, for a full range of travel reductions, and for a range of traveller numbers. A detailed manuscript describing the rationale and mathematics of this modelling work has been submitted to a specialised journal.

This issue is not only of relevance for small island states but also for remote sub-national islands such as those in archipelagos with limited sea or air contact (e.g. see: http://en.wikipedia.org/wiki/List_of_archipelagos). It may also be relevant for New Zealand which has some remote but populated offshore islands (e.g. Stewart Island, Chatham Islands).

Travel volume reductions are most likely to be successful in isolated populations that usually receive less than 10,000 travellers a year. With visitor numbers of that size, this intervention would only have a better than even chance of success if the travel volume reductions were very high (>95% reduction) and for a virus with relatively low infectivity ($R_0 \leq 1.4$, which is at the lower end of the range estimated for the current influenza A(H1N1) epidemic[4]).

Populations with larger traveller numbers would need additional interventions such as screening and quarantining[5] of arriving travellers and the use of antiviral treatment and prophylaxis if they wished to lower the risk of pandemic arrival or substantially delay it. Indeed, most isolated populations would be expected to implement multiple border control interventions. This requirement points to the main limitation of this initial version of EscaVal, which is that it doesn't include the option of investigating the effect of these other interventions.

These additional features will be considered if resources allow development of an expanded version of this tool in the future.

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2. McLeod MA, Baker M, Wilson N, Kelly H, Kiedrzynski T, Kool JL. Protective effect of maritime quarantine in South Pacific jurisdictions, 1918-19 influenza pandemic. Emerg Infect Dis 2008;14:468–70.
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Beliefs about homeopathy among patients presenting at GP surgeries

Current best evidence does not support the use of homeopathy for any indication,[1] although the practice of homeopathy nevertheless appears to be a thriving.[2]

We were interested to explore lay people's understanding of homeopathy and the range of conditions for which it has been used in a New Zealand setting. Specifically, we were interested in the views of those currently seeking out conventional treatments by presenting at their local GP, as one might reasonably expect to find generally sceptical views among people currently consulting traditional medical practitioners than, for example, among customers of health food stores.

Brief self-reporting questionnaires were made available to patients in three GP surgeries in the North Island of New Zealand whilst they were awaiting their consultation. Patients were asked to report their age and gender, whether they know what homeopathy is, whether they believe there is good scientific evidence that homeopathy works, how concentrated are homeopathic preparations, and whether homeopathy should be made available as part of the public health system. They were also asked what conditions they had used homeopathy for and whether they believed that it helped.

Following a 4-week data collection period, 124 completed questionnaires were returned by participating surgeries. The mean age of respondents was 46.3 years (*SD* 17.8 years); 20 were male, 103 were female and 1 did not report. Although the mean age of males was 4.9 years greater than females, this difference was not statistically significant.

Participants' responses regarding their understanding of homeopathy and its perceived effectiveness are shown in the two tables below.

Item	Agree strongly	Agree slightly	No firm opinion	Disagree slightly	Disagree strongly	No answer
I know what homeopathy is	52	53	13	2	3	1
There is good scientific evidence that homeopathy works	41	41	31	6	2	3
Homeopathy should be available as part of the public health system	56	32	26	3	2	5

Item	Very concentrated	Moderately concentrated	Moderately dilute	Very dilute	Nothing there	No answer
How concentrated are homeopathic products?	20	39	21	18	6	20

Eighty participants (65%) indicated that they had used homeopathic products for conditions including bruises, coughs, depression, eczema, joint pain, skin problems, sinuses, and stress. Of these patients, the most frequent response regarding

effectiveness (see table below) was that homeopathy appeared to work 'most times'. (Due to the extensive range of conditions, it was not possible to explore effectiveness by condition treated.) More than 92% of users believed that homeopathy helped at least sometimes and 65% of users believed that it helped most times or every time.

Item	Every time	Most times	Sometimes	Never	No answer
How often does homeopathy help?	11	41	22	4	2

Contrary to expectation, our survey suggests that among patients consulting orthodox medical practitioners, the majority of respondents believe that they understand how homeopathy works, that it is supported by scientific evidence, is concentrated, and helps the condition for which it was being taken.

These findings suggest that scientific evidence is not communicated well to the lay public, but, contrarily, homeopathy is being marketed effectively and still has considerable appeal to general members of the public. In addition, as most homeopathy users believed that it works despite the complete lack of scientific plausibility or evidence, there must be other explanations for its apparent success including placebo responses and confusion between clinical improvements due to homeopathy and the natural history of the illness.

Shaun Holt
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Andrew Gilbey
Palmerston North

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1. Ernst E. A systematic review of systematic reviews of homeopathy. Br J Clin Pharmacol. 2002; 54(6):577–82.
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Margaret Fraser Gatman

Dr Margaret Fraser Gatman (nee Hunter) was born in Ipswich, Queensland, Australia on 12 March 1913. Her family later moved to Dunedin and she completed her secondary education at Columba College for Girls, Dunedin. She entered Otago Medical School in 1932, where she was one of only 3 women in a class of 85, and qualified at the end of 1938.

The outbreak of World War 2 saw Dr Margaret in the middle of her 2-year stint as a House Surgeon, firstly at Dunedin and then Wanganui Hospitals.

Much to her disappointment her plans to specialise in Obstetrics and Gynaecology in Sydney were thwarted by the Dept of Internal Affairs as she was "manpowered" to stay in New Zealand.

In 1941 she returned to Dunedin Hospital to take up the position of Resident Medical Officer—the only female on the Medical staff.

It was during this time that Dr Margaret met her future husband, Mervyn Gatman, who qualified from Otago Medical School in 1941. They were married on 1 May 1942 and later that year Dr Mervyn entered the Army and was posted overseas. During his absence Dr Margaret took a long locum on the Taeiri Plains at Mosgiel, and later in the war moved back into Dunedin to set up a private practice.

At the conclusion of the War she joined her husband in the UK where he pursued a number of research projects at Cambridge University and elsewhere. Dr Margaret did not work during that time as she was busy bringing up three children.

The family returned to New Zealand, and in 1953 Dr Mervyn and Dr Margaret purchased a medical practice from Dr MacDiamid, situated at "Stewart House", in Lake Road, Takapuna. The large residence also included the purpose-built consulting rooms. They worked in partnership in what was a very busy and popular practice. With her specialty being obstetrics, Dr Margaret was a familiar figure around the small obstetric hospitals that dotted the North Shore in the 1950s and 1960s, and later at North Shore Hospital.

Also during these years she was prominent within the NZ Medical Women's Association being president of the Auckland Branch 1968–69 and subsequently created an honorary life member. She travelled overseas on a number of occasions to attend international congresses of the MWIA.

Following the death of Dr Mervyn in 1990, Dr Margaret continued to practice until she retired at the age of 83 in 1996.

For many years she was an active member of her Church in Takapuna and her leisure activities included cooking, reading, gardening, holidays spent camping, and later staying on the family property in the Far North, theatre, travel, and (until restricted by infirmity) hiking. The latter included tackling the South Island tracks and most memorably in 1975 (by now in her 60s) a trek though Nepal (as team doctor) with a group of women led by June Mulgrew (now Lady Hillary).

Dr Margaret passed away on the 9 January 2009 in her 96th year. She is survived by her three children; Lionel, Margaret (Callaghan), and Marian (Smith);
8 grandchildren; and 6 great grandchildren.

Lionel Gatman wrote this obituary.

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The Facts: Head Injury

A Daisley, R Tams, U Kischka. Published by Oxford University Press, 2009.
ISBN 9780199218226. Contains 172 pages. Price £12.99

The Facts: Head Injury is a book which doctors should have, not for themselves but to give to their patients who have family members who have suffered a head injury. Therefore this book is not directed at medical students or doctors learning about acute medical or surgical managements of head injury.

There are a number of contributors to the book; the speciality areas being neuro rehabilitation, clinical neuropsychology, speech language therapy, and relationship and psychosexual therapy. The emphasis of the book is therefore not so much on the acute management of patients but more the long-term rehabilitation problems that these patients have. The book also provides strategies for managing the various problems and also to provide advice on being able to cope with the problems themselves.

Each of the chapters begins with a section of key points which are covered during the subsequent discussion in the chapter. The text is written in a easily digestible form and is broken up into sections such that can be easily followed. Very often questions are posed as titles which are subsequently answered.

The first chapter is an overview of the problem of head injuries and discusses the importance of coping with this and how one should go about this in a more generalised fashion. The second chapter looks at how the brain works and what happens when it is damaged. The third chapter looks at the acute management of a head injury at the primary hospital and discusses the medical and sometimes surgical management which is needed to help these patients.

The bulk of the book, however, is broken up into five chapters which look at the long-term sequelae of patients with a head injury. There are chapters on the physical problems, the problems with thinking skills, changes in language, problems with emotions and behaviour, and (finally) problems with sexual functioning. There is a further chapter on family issues after head injury which goes into more detail about how this often can affect the family and how they can learn to support the injured relative. The final chapter is directed particularly at children with family members with a head injury and describes the process in a language which would be easily understandable to younger children.

The final chapter titled “the longer term” addresses problems which patients may particularly have when they return home such as returning to work, driving and other leisure activities. In the appendix there is a comprehensive list of resources which may be accessed for help. There are some references, however, to books and websites.

Any doctor looking after a patient and their family following a head injury would understand the vast amount of support which is necessary to help family members

understand and cope with the problem of a relative with a brain injury. Although personal support and advice is extremely valuable, this book will be an additional source of information to help them through this.

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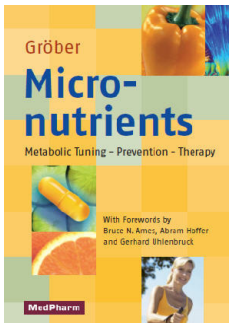
Micronutrients: Metabolic Tuning - Prevention - Therapy

Uwe Gröber. Published by MedPharm Scientific Publishers (Stuttgart, Germany), 2009. ISBN 9783804750395. Contains 480 pages. Price EUR 39.00

Uwe Gröber is described as one of Germany's foremost experts on micronutrients. This book is divided into 3 parts and covers vitamins, minerals, trace elements, antioxidants, essential fatty acids, conjugated linoleic acid, squalene, and amino acids.



The first part 'Micronutrient Profiles' includes physiological and biochemical functions, causes of deficiency, and increased requirements (e.g. medical conditions, medications, pregnancy). It is particularly useful to read clear descriptions of clinical symptoms of deficiency—e.g. changes in tongue, skin, nails, restless legs, sleep, mood, fatigue, weakness. Relevant measures for nutrient status are provided (e.g. whole blood, serum, erythrocyte, urine) with practical advice on fasting and techniques for sample collection.

Dosing for prevention and treatment of specific conditions is tabled, outlining the optimal form (e.g. complexed with an organic acid), route of administration, duration of treatment, timing with meals, contraindications, safety, and specific interactions with medications.

The second part of the book covers 'Micronutrients in Prevention and Therapy', for more than 50 medical conditions including Acne, Asthma, Cardiovascular disease, Chronic Obstructive Pulmonary Disease, Diabetes, Heart failure, Hyperhomocysteinaemia, Hyperlipidaemia, Hypertension, Inflammatory Bowel disease, Sleep disorders, as well as Competitive sports.

A short overview of the condition is followed by causes of deficiency or increased requirements, laboratory parameters and recommended dosage for the relevant nutrients.

The final section of this book clearly tables 'Selected Therapeutically Relevant Drug and Nutrient Interactions'. Drugs are grouped according to their primary use (e.g. Antacids and Acid blockers, Analgesics, Antihypertensives) and the nutrient interactions identified.

The book fills a vital gap in clinical practice for treating micronutrient deficiencies. Specifically it meets the need for a clear guide on symptoms of deficiency, parameters for measuring status, and optimal dosing.

Not all tests are routinely available in the laboratories and may be costly, but a range of parameters are given—which should improve the use of relevant testing, interpretation of the results, and subsequent treatment.

The final sentence on the back cover describes the book as having "many of the qualities of a vitamin—small size and east-to-digest portions packed with high

quality". I agree and recommend it as a very useful guide on micronutrients for health and disease.

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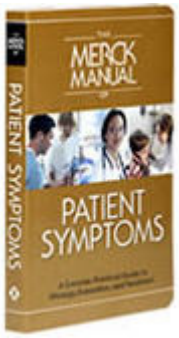
THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

The Merck Manual of Patient Symptoms: a concise, practical guide to etiology, evaluation, and treatment

Robert S Porter, ed. Merck Publishing, 2008. ISBN 0911910117. Contains 600 pages. Price USD24.95

This is a compact handbook which attempts to cover the common symptoms in general clinical practice including paediatrics and gynaecology. It aims to help guide health care practitioners to evaluate patients and begin treatments. The target readers are medical students, nurse practitioners, and general practitioners.



Each chapter is headed by a common symptom, a brief discussion of its pathophysiology, then aetiology, followed by evaluation of the symptoms by history taking, physical examination and tests, and finally a brief discussion of treatment. It was most helpful to have the causes and associated suggestive findings listed in a table. One can learn a lot from just a quick glance. However, instead of listing the causes in alphabetical order, it would have been more useful if it was listed based on how common each cause was. It is not clear what criteria were used to decide the order.

The authors have written the book in such a manner that the evaluation is carried out based on understanding of typical clinical patterns. For example, brief explanations in brackets were found throughout the book (wherever relevant) to guide the reader towards the most likely diagnosis. The difficulty with handbooks that aim to cover so much is to know what to leave out.

There are several Red Flag boxes scattered in each chapter which is a good reminder for the important signs which should not be missed out on.

The authors have successfully approached each common symptom in a logical and concise manner without getting too carried away with excessive minor details. As such it is a good handbook only and does not provide you with all the necessary information on investigations and treatment once you have narrowed your differential diagnosis.

Overall, we found it a useful book to have, but not suitable for hospital use.

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