Product evaluation – Polyacrylate Strands: A Cavity Wound Dressing

Gary Bain and Natalie Potts

Summary

The wound management department (WMD) of the Sydney Adventist Hospital undertook a 3-month evaluation of a new cavity wound dressing – AcryDerm Strands™. When utilised on a variety of wounds, including dehiscence, pressure ulceration and fungating tumours, the product was found to provide clinical, as well as patient comfort and cost-saving, advantages.

Introduction

Cavity wounds are reasonably common in both the hospital and community nursing domains. While such wounds can be small and straightforward to manage, they may just as easily involve extensive tissue loss, undermining, sinus tracking and fistula formation and thereby represent a significant challenge.

Pathologies responsible for wound cavitation vary and include factors like infection, haematoma, vascular compromise, pressure injury, cancerous erosion, radiation and trauma [1-5]. The traditional approach of packing the wounds with ribbon gauze products is well-documented [1, 2, 5-8].

In recent years journal literature has drawn attention to the characteristics desirable in an 'ideal wound dressing' [4, 9-11]. Bale [10] suggests that products possessing these traits "... aim to provide an environment in which healing can proceed at the optimum rate." Numerous wound pharmaceuticals incorporating the principles of the ideal dressing now exist and have been shown to facilitate repair in the cavity wound [8, 11-17] (refer to Table 1).

An alternative to dressings for managing large-volume tissue deficit is the vacuum-assisted closure technique developed by Argenta and Morykwas [18]. This method has been shown to be effective in dehisced wounds, pressure and leg ulcers, open amputations and acute avulsions. However, its limitations include the necessity of removing all necrotic debris from the wound and establishing haemostasis prior to its application. Pain and trauma to granulation tissue on removal of the foam insert have also been recorded [11]. In addition, the pump and tubing do not encourage patient mobility and independence and the device is not readily accessed in community settings.

A new dressing – AcryDerm Strands™ Absorbent Wound Dressing (AcryMed, Portland, Oregon USA) – is indicated for use in cavity wounds. While the dressing's manufacturing process and commercialisation are American, its design concept and formulation originated in Dunedin, New Zealand. There is a small volume of non-published clinical trial data on the product, including comparative studies with competitor products.

Sydney Adventist Hospital's WMD decided to conduct a 3-month product evaluation of AcryDerm Strands, in order to explore the dressing's performance characteristics in acute care and community nursing settings. The appropriate administrative and ethics approval was gained prior to appraisal of the dressing.

Technical Information

AcryDerm Strands, a synthetic hydratable and semi-permeable polymer, comprise polyacrylate, polysaccharides and glycerin. The polymer is manufactured as a single sheet, then partially shredded to present as a ball of 'noodles' or filaments. These worm-like projections or strands remain connected to a central island of intact sheet and do not separate or shed. The cutting process dramatically increases the surface area of the dressing, enhancing its capacity to absorb fluid via the polysaccharide molecular structure, while the glycerin component ensures the filaments do not dry out in wounds with low exudate.

Promotional material accompanying the dressing suggests that AcryDerm Strands can be used in the majority of wounds, even leg ulcers and donor sites, the only contraindication being

Gary Bain RN CNC MClinEd BN DipApSc
Director, Wound Management Services
Sydney Adventist Hospital
Associate member, Wound Foundation of Australia

Natalie Potts RN BAppSci
Wound Management Nurse Specialist
Sydney Adventist Hospital
New South Wales, Australia

Table 1. Dressings used in cavity wounds.

- Alginates
- Charcoal-impregnated products
- Dextranomer beads
- Hydroactive polymers
- Hydrocolloids
- Hydrofiber
- Hydrofoams
- Hydrogels
- Silastic foam
- Sugar pastes

full-thickness burns. The product is recommended for lesions complicated by tunnelling or undermining, as well as those with slough and necrotic content, high volumes of discharge and/or requiring the protection of granulating tissue. Thus, the dressing is suitable for cavity wounds that are infected, require autolytic debridement or are progressing towards closure. Proposed performance characteristics of AcryDerm Strands are recorded in Table 2.

Product Evaluation

Design of the evaluation

Inclusion criteria for the evaluation included informed consent where the patient's wound extended to a minimum depth of 1 cm, with minimum surface dimensions of 4 x 4 cm. These criteria were selected to minimise the amount of handling and wastage associated with the product, since the WMD clinicians chose not to retain or store any unused portions of the AcryDerm Strands between patient consultations. In addition, the WMD was specifically interested in utilising the dressing on reasonably deep and sizeable wounds. Patients with full-thickness burns were not included.

Over the appraisal period 10 patients participated in the product assessment. Those involved in the study were generally reviewed once per week in the WMD's outpatient clinic. In four cases, community nurses continued with care of the patient and contributed to evaluation of the dressing. Each patient remain-ed in the treatment program until his/her wound became too shallow to retain the AcryDerm Strands, the patient chose to withdraw, died, was transferred to another health-care facility or underwent surgical closure of the wound. Types of wounds treated included pressure ulcers, dehiscence, trauma and fun-gating tumours.

Table 2. Reported properties of Acryderm Strands.

- Donate moisture to the wound environment
- Facilitate autolytic debridement
- Resist drying out
- Matrix maintains integrity on contact with the wound
- Absorbent
- Conformable
- Transparent
- Semi-permeable
- Non-adherent

Clinicians used the WMD's standardised evaluation form to obtain objective as well as subjective data on the performance of the dressing. A concise depiction, extensive measurement and quantitative description of each wound were undertaken at the beginning and end of each patients' involvement in the study. Dressing performance was rated against nine variables at each dressing change (see Table 3).

Table 3. Variables used to assess dressing performance in evaluating AcryDerm Strands.

- Ease of insertion
- Conformability/fit to wound
- Dressing comfort
- Duration of dressing/dwell time
- Secondary dressing used
- Amount of exudate/strike-through
- Ease of removal
- Containment of odour
- Condition of surrounding skin

Case histories

A summary of the management of three patients involved in the evaluation will now be presented, to provide an insight into the performance of AcryDerm Strands. These case histories are rep-resentative of overall study findings.

Case 1

Mr H, who was 85 years of age, presented to the WMD clinic with a squamous cell carcinoma erosion in the right groin (see Figure 1). The wound extended to the deep fascia and initially measured 38 x 24 mm. There was copious seropurulent exudate accompanied by a strong odour. Mr H was already being

Figure 1. Squamous cell carcinoma erosion.

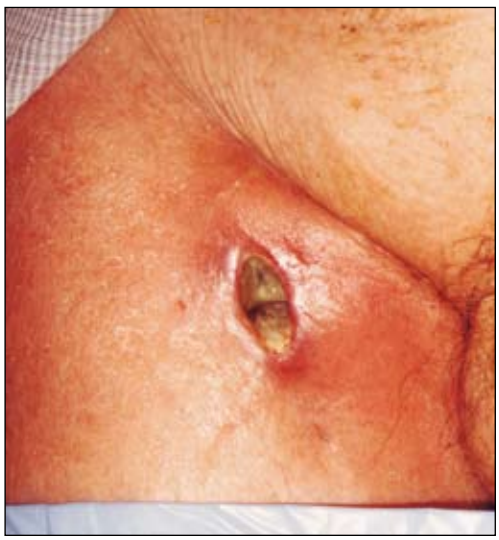
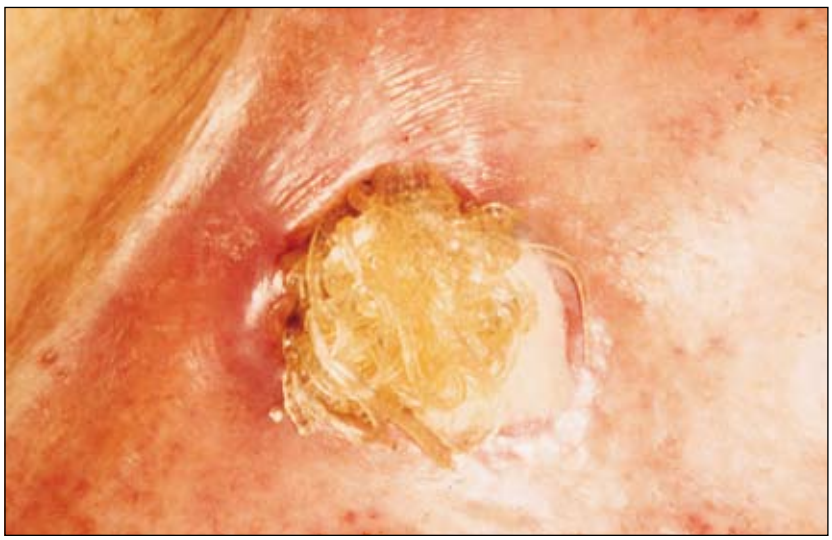


Figure 2. AcryDerm Strands *in situ*.



treated on a daily basis by community nurses, who packed the wound with an alginate ribbon and secured the dressing with a combine pad. The cost of the procedure – $13.65 – included both materials and labour (see Table 4).

Mr H commented that his main difficulties with the wound were 'strike-through' (staining clothing and bed linen) and the offensive odour, which rendered him socially isolated. AcryDerm Strands were subsequently inserted in the cavity wound (see Figure 2) and secured with an absorbent pad. Insertion was straightforward and the patient said the dressing was comfortable. The total cost of the procedure was $11.72.

The following day, when the community nurse examined Mr H's dressing, there was no strike-through and notably less odour than when the alginate was used. There was, however, an extrusion of strands or noodles from the wound, since the dressing had enlarged as it absorbed exudate. This situation necessitated a dressing change, with a smaller volume of AcryDerm Strands inserted. Dwell time for the renewed dressing was extended to 2 days as it continued to absorb and contain discharge and odour.

This regime was maintained while Mr H remained an outpatient. Over the next 9 weeks, however, his health deteriorated and he was withdrawn from the study following his admission to a hospice, where he died a few days later.

Case 2

Mrs G was 70 years of age, had a history of chronic renal failure and had been on haemodialysis twice a week for some years. She had recently required a left hemicolectomy to relieve a partial bowel obstruction. Her recovery was slow and difficult. At day 6 post-surgery the inferior half of the incision began dis-charging a steady brown ooze. Although there was little peri-wound erythema, the patient was pyrexic and experiencing increased wound pain. On day 8 after surgery the wound

Table 4. Costing comparison for cases histories 1 and 2.

Case history	Pre Strands regime (A)	Frequency of dressing changes (A)	Cost of regime A per day	Frequency of Strands dressing (B)	Cost of Strands regime per day (B)
1	Alginate ribbon, combine pad	Daily	Materials $8.90 Labour $4.75 **Total $13.65**	Every 2 days	Materials $4.75 Labour $6.97 **Total $11.72**
2	Povidone-iodine, gauze ribbon, combine pad	Three times per day	Materials $14.70 Labour $17.10 **Total $31.80**	Daily change	Materials $21.40 Labour $3.80 **Total $25.20**
Cost difference (case 1) $1.93. Cost difference (case 2) $6.60. *[NB: Labour cost based on an hourly wage rate of $19.00.]*					

de-hisced, revealing a deep cavity 45 mm in depth and 102 x 72 mm in the remaining two dimensions. Approximately 45 per cent of the wound surface area presented with red tissue, which looked like it might progress to granulation tissue. The balance of the wound contained a mixture of necrosis and slough and the volume of exudate was high. Mrs G was distressed by the odour the wound produced (see Figure 3).

Ward protocol for dressing the wound consisted of povidone-iodine soaked ribbon gauze covered with absorbent pads, with the process performed three times daily. Frequency of dressing changes was determined largely by the extent of the discharge. The daily cost of the dressing procedure was $31.80.

Staff from the WMD began caring for Mrs G just prior to her discharge from the ward on post-operative day 19. It was decided to adopt a coordinated approach, with care provided by both the WMD and renal dialysis unit. The dressing regime was tailored to meet the demands for exudate absorption, containment of odour, autolytic debridement and patient comfort. AcryDerm Strands were selected in an attempt to fulfil these requirements. Two pods (each equivalent to a single 6-gram unit or dressing) of the strands were inserted into the wound (see Figure 4) and retained with combine pads and an abdominal binder. The cost of this regime was $25.20 per day.

Over the next 8 days the AcryDerm Strands dressing was changed once daily to manage the volume of drainage. The patient was more comfortable and required less narcotic analgesia. While the odour was not completely contained, both Mrs G and the staff believed its offensiveness had been reduced. Notably, the volume of necrotic and slough debris had decreased, now occupying 30 per cent of the wound surface area. It was observed that the AcryDerm filaments had expanded to at least four times their dry-weight volume and 'contained' large amounts of lysed tissue, coagulum and exudate.

As the amount of devitalised tissue and volume of discharge decreased, the AcryDerm Strands dressing could remain *in situ* longer. By post-surgery day 31 the cavity wound was being dressed every 3 days.

At this time the wound showed a clean, healthy bed of granulation tissue (see Figure 5). Mrs G returned to the operating theatre and had her abdominal wound closed. No further non-healing events have been reported.

Case 3

Mr S, aged 73, had undergone cardiac bypass grafting, which had been complicated by a major cerebral vascular accident, acute renal failure and bilateral pulmonary effusions. During the course of his treatment he developed a pressure ulcer over the sacrum and left buttock. At 24 mm deep and extending to dimensions of 68 x 50 mm, the ulcer was covered with dry eschar over 80 per cent of its surface area. This tough, leathery

Figure 3. Mrs G's wound.

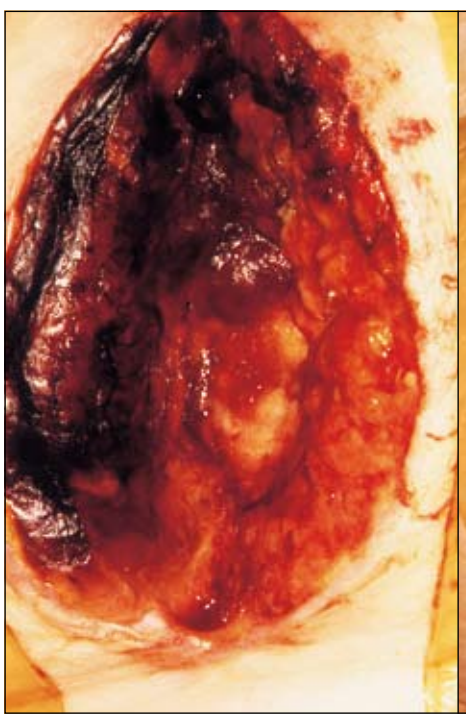


Figure 4. AcryDerm Strands *in situ*.

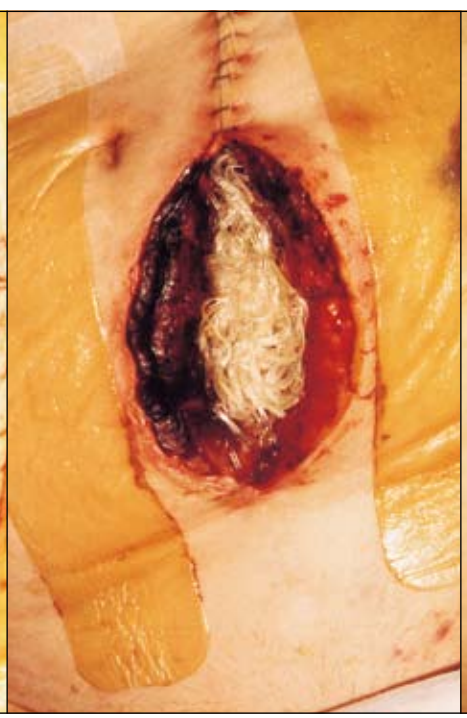
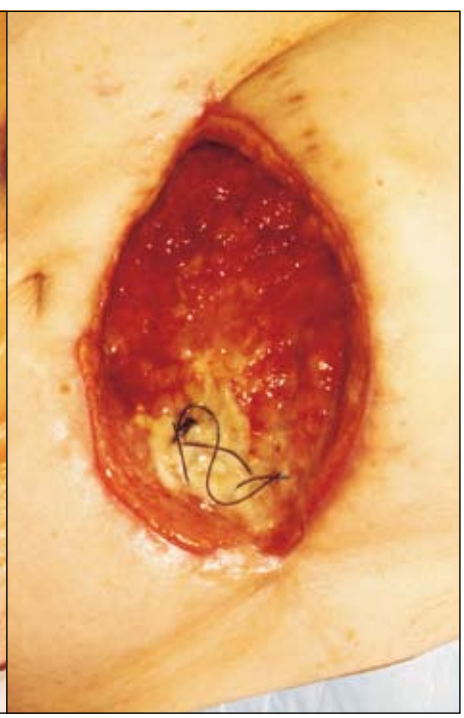


Figure 5. The granulating wound.



black tissue was surgically debrided, exposing a liquefied sludge incorporating necrosis and slough.

The patient had already been commenced on a low air-loss bed prior to clinicians from the WMD becoming involved in the case. Mr S's wound was dressed with one AcryDerm Strands pod, covered with a film dressing. Within 2 days the entire dressing was changed, since the volume of exudate and water vapour trapped by the film led to loss of adherence and subsequent leakage of fluid. Altering the regime so that the strands were secured by Tielle™ (Johnson & Johnson Medical) proved successful in that dwell time for the dressing was enhanced, resulting in a twice-weekly dressing change indicated by uniform staining to the surface of the Tielle.

In this case, nasogastric feeds, improved oxygenation, intensive physiotherapy and pressure relief provided the basis for a steady recovery, while the dressing regime created a local environment that rapidly produced autolytic debridement. Within 16 days of commencing this dressing therapy, the wound was clear of devitalised tissue. Granulation tissue had begun to reduce the ulcer's depth and contraction of the wound margins was apparent. Two weeks later the AcryDerm Strands were discontinued because the pressure sore was too shallow to contain the filaments. A thin hydrocolloid was then used to cover the wound, which continued to progress towards closure.

Patient outcomes

None of the 10 patients involved in the product evaluation chose to withdraw from the treatment program. Those who were transferred to the care of another facility or the community nurse were supplied with AcryDerm Strands, instructions for their use, a report on the patient's history and presentation throughout the evaluation period prior to transfer, and a contact number for the WMD, for follow-up and practitioner support.

During the appraisal interval two patients died, succumbing to metastatic disease and gross septicaemia respectively. Four patients' wounds progressed to closure by secondary intention and one patient's wound healed via delayed primary closure. The wounds of the remaining three individuals were still open at the conclusion of the evaluation but all were healing.

Discussion

When AcryDerm Strands were used in cavity wounds they were found to be easy to insert, comfortable and accommodating for a wound bed, being prone to movement and alterations in shape. No wound pain associated with dressing application, dwell time or removal was reported and there was no adherence between wound bed and product.

The dressing's capacity to absorb and contain exudate was remarkable. Its filaments expanded in three dimensions and were seen to cover a surface area up to six times the size of the dry dressing pod. Usually there was little 'free' fluid within the cavity wound, since most of the discharge was held within the strands' polysaccharide molecular structure. Devitalised tissue, slough and assorted debris were likewise assimilated and confined by the mass of filaments. The moistened polysaccharide chains, in combination with the impregnated glycerin, formed a gel-like coating to promote thermal insulation, autolytic debridement and non-traumatic removal of the dressing. Thus, the strands' performance during the evaluation was consistent with many of the manufacturer's claims for the product.

Selecting a suitable secondary dressing was an important consideration when designing an AcryDerm Strands regime. The degree of occlusion of the secondary cover controlled the quantity of water vapour retained within the wound, which in turn influenced the strands' rate of absorption, expansion and gelling. Heavily-exuding wounds required a highly vapour-permeable secondary cover, while drier lesions benefited from a more moisture-retentive canopy.

During the evaluation period, a few patients experienced protrusion of the AcryDerm Strands filaments from beneath the secondary cover. This inevitably led to leakage, which in turn caused some participants distress. On these occasions it had to be determined whether too great a volume of the strands had been used, not allowing for expansion of the product, or the secondary dressing was too occlusive, leading to accumulation of water vapour and a subsequent rapid increase in the dimensions of the strands. The solution to this management issue was not always straightforward and some 'trial and error' was necessary to achieve a satisfactory outcome. More investigation is needed to arrive at a procedural recommendation for the product's exact usage.

AcryDerm Strands' ability to expand caused two patients to remark on a 'sensation of pressure' within their wounds. This was not described as painful and no analgesia was required. On inspection, it was noted that the strands had fully conformed to the dimensions of the wound, with further expansion retarded by the secondary dressing cover. This circumstance was corrected when a reduced quantity of strands was used.

One advantage of the dressing's capacity to exert pressure within a restricted space was the generation of a tamponade effect when bleeding was apparent within the wound bed. Blood loss was absorbed by the filaments but significantly reduced once the strands swelled to occupy the wound. This finding was used to good effect in the patient with a friable, fungating tumour.

In a small number of dressing procedures, the dressing's filaments became detached from their central base, but no consistent reason for this was determined. The unfettered, slippery 'noodles' were in some instances time-consuming and awkward to remove, especially if lodged in areas of undermining. In most cases, however, irrigation with normal saline and retrieval with a gauze pad were sufficient. However, the WMD clinicians concluded that, because of the risk of filament detachment, packing of sinus tracks with AcryDerm Strands should be done with great caution.

The product's proficiency at containing odour varied. Odour decreased (as assessed subjectively by both patient and clinician) when AcryDerm Strands were used in heavily draining wounds with little necrosis, but odour control was less efficient where the percentage of necrosis in a wound was greater. Interestingly, however, the dressing's capacity to limit malodour was superior in the treatment of the fungating wound than in its application in a full-thickness, necrotic pressure ulcer.

Although the strands were not inserted into a cavity wound with an intact, dry eschar cover, it appears unlikely that any benefit would ensue from such application, since the wound/dressing interface would be too dry. Surgical or conservative sharp wound debridement of the eschar would seem the preferable option, prior to selection of the strands and an appropriate secondary dressing.

Conclusion

It was found that AcryDerm Strands could promote rapid debridement, minimise wound pain, contain exudate and reduce malodour and were generally easy to insert and remove. Selection of a secondary dressing has important implications for the performance and dwell time of the strands. Likewise, the amount of product placed in the wound cavity must be carefully judged and reassessed, in order to gain maximum benefit from the dressing. Its advantages for clinicians include a reduction in the number of dressing changes and cost savings over the course of a management regime (refer to Table 4).

On conclusion of the product evaluation, the WMD clinicians were able to recommend AcryDerm Strands as an effective addition to the armoury of modern wound cavity dressings.

Acknowledgements

Staff of Sydney Adventist Hospital's WMD thank community nurses Lynda Wright, Morgie Bleink and Eileen Kenny for their assistance in this product evaluation.

References

1. Black C. Wound management in patients with traumatic injuries. J Wound Care 1997; **6**(5):209-11.
2. Shutler SD, Jones M & Thomas S. Management of a fungating breast wound. J Wound Care 1997; **6**(5):213-14.
3. Lotti T & Benci M. Wound-healing problems associated with cancers. J Wound Care 1998; **7**(2):81-84.
4. Fox C. Minimising risk factors in pressure sore care. J Wound Care 1998; **7**(2):87.
5. Fritz C & Hewitt P. A case study: the parastomal wound – a management problem. Primary Intention 1994; **2**(1):10-12.
6. Foster L & Moore P. The application of a cellulose-based fibre dressing in surgical wounds. J Wound Care 1997; **6**(10):469-73.
7. Cannavo M, Fairbrother G, Owen D, Ingle J & Lumley T. A comparison of dressings in the management of surgical abdominal wounds. J Wound Care 1998; **7**(2):57-62.
8. Berry DP & Jones M. Cavity wound management. J Wound Care 1993; **2**(1):29-32.
9. Johnson A. Towards rapid tissue healing. Nursing Times 1984; **28**:39-43.
10. Bale S. Assessment of cavity wounds. The Dressings Times 1990; **3**(1): 1-2.
11. Hardcastle MR. Vacuum-assisted closure therapy: the application of negative pressure in wound healing. Primary Intention 1998; **6**(1):5-10.
12. Regan M. The use of Intrasite Gel in healing open sternal wounds. Ostomy/Wound Management 1992; **38**(3):15-21.
13. Thomas S. A guide to dressing selection. J Wound Care 1997; **6**(10):479-82.
14. Bain G. The use of hydrogel packing for the management of extensive soft tissue wounds. Primary Intention 1996; **4**(4):20-23.
15. Boardman M. Treating a patient with a heavily exuding malodorous fungating ulcer. J Wound Care 1993; **2**(2):74-76.
16. Clark L. Caring for fungating tumours. Nursing Times 1992; **88**(12):66-70.
17. Berry DP, Bale S & Harding KG. Dressings for treating cavity wounds. J Wound Care 1996; **5**(1):10-13.
18. Argenta LC & Morykwas MJ. Vacuum-assisted closure: a new method for wound control and treatment: clinical experience. Ann Plastic Surg 1997; **38**(6):563-76.