TEMPORARY COVERAGE OF BURNS WITH A XENOGRAFT AND SEQUENTIAL EXCISION, COMPARED WITH TOTAL EARLY EXCISION AND AUTOGRAFT

EXCISION SÉQUENTIELLE DES BRÛLURES ET COUVERTURE TEMPORAIRE PAR XÉNOGREFFE, COMPARÉE À L'EXCISION TOTALE ET PRÉCOCE SUIVIE D'AUTOGREFFE

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SUMMARY. During the 80s and 90s, early and total excision of full thickness burns followed by immediate autograft was the most common treatment, with repeated excision and grafting, mostly for failed grafts. It was hypothesized, therefore, that delayed coverage with an autograft preceded by a temporary xenograft after early and sequential smaller excisions would lead to a better wound bed with fewer failed grafts, a smaller donor site, and possibly also a shorter duration of stay in hospital. We carried out a case control study with retrospective analysis from our National Burn Centre registry for the period 1997-2011. Patients who had been managed with early total excision and autograft were compared with those who had had sequential smaller excisions covered with temporary xenografts until the burn was ready for the final autograft. The sequential excision and xenograft group (n=42) required one-third fewer autografts than patients in the total excision and autograft group (n=45), who needed more than one operation (p<0.001). We could not detect any differences in duration of stay in hospital / total body surface area burned% (duration of stay/TBSA%) (2.0 and 1.8) (p=0.83). The two groups showed no major differences in terms of adjusted duration of stay, but our findings suggest that doing early, smaller, sequential excisions using a xenograft for temporary cover can result in shorter operating times, saving us the trouble of making big excisions. However, costs tended to be higher when the burns were > 25% TBSA.

Keywords: burn surgery, xenograft, sequential excision, total early excision, autograft

RÉSUMÉ. *Pendant ces dernières décades, l'excision précoce et totale des brûlures profondes, suivie immédiatement d'autogreffe a constitué le traitement le plus habituel avec souvent, en cas d'échec, des excisions répétées et de nouvelles greffes. Nous avons pensé, cependant, que la couverture par autogreffe retardée, précédée par une couverture temporaire par xénogreffe après des excisions itératives et moins larges permettait d'obtenir un meilleur lit receveur avec moins d'échecs, des sites donneurs plus petits et une durée d'hospitalisation moindre. Nous avons ainsi mené une étude analytique rétrospective dans notre Centre National de Brûlés pendant la période 1997-2011. Les patients qui avaient été traités par une excision précoce totale suivie d'autogreffe ont été comparés à ceux qui avaient eu des petites excisions séquentielles, couvertes de façon temporaire par des xénogreffes jusqu'à ce que la brûlure soit prête pour une autogreffe finale. Le groupe excision séquentielle et xénogreffe (n=42) a nécessité un tiers de moins d'autogreffes que les patients qui avaient une excision totale suivie d'autogreffe (n=45) et plus d'une seule opération (p<0001). Nous n'avons pas remarqué de différence dans la durée d'hospitalisation en fonction de l'étendue de la surface brûlée (durée du séjour TBSA%) (2,0 et 1,8) (p=0,83). Les deux groupes n'ont pas montré de différence majeure en terme de durée d'hospitalisation, mais l'excision précoce, limitée et séquentielle avec une xénogreffe temporaire, permet de réduire le temps opératoire et évite les excisions trop généreuses. Cependant les coûts ont tendance à être plus élevés avec les brûlures de 25% ou plus de TBSA.*

Mots-clés*: chirurgie des brûlés, xénogreffe, excision séquentielle, excision totale et précoce, autogreffe*

Introduction

In 1983 Engrav et al.[1] described the efficacy of early excision of burns and immediate autografting compared with the widely-used conservative management plan for burns used at the time. Since then, most centres in the western world have been following these principles, but with somewhat different approaches. The use of xenografts was introduced in parallel with early excision of burns. We are currently aware of little evidence about which is the best approach for combining ex-

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cisions, grafting and use of xenografts.[2]

At this centre we have used different approaches for the early excision of burns over time, in the same way as we have gradually moved towards more outpatient-based care of burned patients. The two surgical techniques used in the present study were first implemented in the 1990s, inspired by Janzekovic et al.[3] and Herndon et al.,[4] and comprised immediate excision and autograft. The plan was later updated to the technique proposed by Still et al.,[5] which included early sequential excision and the use of xenografts as temporary substitutes before autografting. This allowed more precise demarcation of burned areas, optimised the wound bed, and minimised the rate of graft failure. The latter was thought to be important as it might lead to an overall reduction in duration of stay in hospital.[5] However, the comparison made by Still et al. lacked a control group from the previous regimen (total excision and immediate grafting).

Herndon et al.[4] and other authors[6-8] used mortality as an outcome indicator for their new management plans. However, it is of limited use today because mortality in modern burns units is very low.[9-11] Duration of stay in hospital reflects the time that the wound takes to heal, and is used to quantify the efficiency and the quality of the service.[12-14] In the USA in the 80s, the consensus was that burn centres should be able to maintain at or below one day/TBSA%. Almost a decade later, a review of outcomes of burns from the predecessor of the National Burn Repository (NBR) (The American Burn Association's Patient Registry) conducted by Saffle et al. showed that the goal was being achieved.[15] However, more recently it was shown that it needs to be adjusted for those patients who need skin grafts compared with those who are treated conservatively. Engrav et al. had shown that patients who need an operation usually spend longer in hospital than those who do not.[16]

Using a case control design, we aimed to compare results in patients treated with smaller, sequential excisions covered with xenografts as temporary cover until it was time for the final autograft, with the results of treatment with total excision and autograft.

Methods

The study group included all patients who were managed by excision and autografting during the period 1997–2011. To avoid overlap between the two treatments, we compared results in patients from 1997-98 who were managed by early total excision and immediate autograft, or conservatively using silver sulphadiazine dressings, with those of patients from 2010-11 who were managed by sequential excisions and delayed autografts using xenografts as temporary skin coverage or conservatively using xenograft dressings. Partial thickness burns were treated conservatively in both groups. The patients were divided into two sub-groups: burns < 25% total body surface area burned (TBSA%) and burns > 25% TBSA.[5]

The data that had previously been gathered prospectively were analysed retrospectively using the local computerised patient data registry system (The Burn Unit Database - BUD), in which the nursing staff enter all patients' data daily. The data registry system automatically provides data to other registries, including The American College of Surgeons, The National Burn Repository and The Swedish Intensive Care Registry, as previously described.[17]

These patients are treated according to our regimen[17] with standard ventilation,[18] fluid management,[19] early enteral nutrition and laboratory assessment, according to a pre-set protocol.[20] Ringer's acetate is used for fluid resuscitation in volumes according to the Parkland formula (4 ml x kg body weight x TBSA%), with adjustments for urine output.[21]

On admission, burn severity is assessed by a surgeon, whose clinical examination takes into account the appearance, capillary refilling and sensory function of burned areas, and data are recorded in a detailed Lund & Browder chart. The plastic surgeon is responsible for taking care of the burn wounds, and an anaesthetist takes care of the general condition and nutritional state of the patient. A specialised, multidisciplinary paramedical team is responsible for the patient's rehabilitation and physiotherapy. In cases of infections, antibiotics are given according to the results of culture and sensitivity tests, but prophylactic antibiotics are not administered.[22]

The plan for the total excision and autograft group was total single excision and immediate autograft about one day after injury. The burn was excised only as long as the condition of the patient was acceptable, and autografts were applied immediately after excision. The grafts were first checked after 5-7 days. Further operations for regrafting were considered in the event of non-take of the skin grafts.

The sequential excisions and xenograft group had staged excisions starting around 2-4 days after injury with a maximum limit of 20% excised burned body surface area (excised BSA%) or two hours operating time, with xenografts applied as temporary skin substitutes. The operations were continued every other day until completely excised and, together with checking the xenografts and ensuring optimal wound bed, skin grafts were applied a median of 8 (1-17) days after injury. The grafts were first checked after 5-7 days and then 3 times/week.

Variables recorded were: duration of stay/TBSA% and duration of stay/excised TBSA%, total excised body surface area (BSA)%, excised BSA%/operation, total operating time, mean (SD) operating time and number of operations, duration of stay, TBSA%, FTB% (full thickness burn compared with partial thickness), age, sex, cost (billing charges), and grafts used (autografts or xenografts). Billing charges in our burn centre are based on the burn intervention scoring system (BSC score).[17]

Data management and statistics

Data are presented as median 10-90% centiles or mean (SD) as appropriate. Lilliefor's test was used to confirm the normality of the distribution of data. Differences between groups were assessed using the Mann Whitney *U* test and Pearson's chi square, as appropriate.

Data were analysed with the help of STATISTICA (v.10) StatSoft Inc. USA, and probabilities of less than 0.05 were accepted as significant.

Results

Description of the groups studied

A total of 358 patients were examined during the two periods (*Fig. 1*): 169 patients required operation, 62 patients in the total excision and autograft group and 107 patients in the sequential excision and xenograft group (*Table I*). The patients in the sequential excision and xenograft group were older by 15.5 years, TBSA% was smaller, and full thickness burns were also smaller, while there were no sex differences between the groups. The median area excised/operation was smaller, and

Table I - All patients with burns who required operation

	All patients	Total excision and autograft	Sequential excisions and xenograft group	p value
Patients (n)	169	62	107	
Age (years)	42.0 (2.0-73.0)	31.5 (4.0-55.0)	47.0 (2.0-76.0)	0.002
Duration of stay (days)	18.0 (3.0-57.0)	22.0 (5.0-57.0)	16.0 (2.0-57.0)	0.11
First operation day	2.0 (1.0-14.0)	1.0 (1.0-6.0)	3.0 (0.0-15.0)	0.001
Number of operations	2.0 (1.0-5.0)	1.0 (1.0-3.0)	2.0 (1.0-6.0)	0.01
First autograft day	5.0 (1.0-16.0)	1.0 (1.0-6.0)	8.0 (1.0-17.0)	<0.001
Number of autograft operations	1.0 (1.0-4.0)	1.0 (1.0-3.0)	1.0 (1.0-4.0)	0.82
Duration of stay(days)/excised BSA%	2.2 (0.8-8.0)	2.2 (0.8-7.7)	2.1 (1.0-8.0)	0.86
TBSA%	10.0 (1.4-40.0)	15.3 (3.0-40.0)	8.5 (1.0-40.0)	0.01
Superficial and deep dermal BSA%	4.5 (0.0-24.0)	7.0 (0.0-30.0)	3.5 (0.0-21.0)	0.05
Full thickness burns%	1.8 (0.0-23.5)	3.0 (0.0-22.5)	1.0 (0.0-24.5)	0.003
Duration of stay(days)/TBSA%	1.8 (0.7-5.4)	1.6 (0.7-4.1)	1.9 (0.7-7.0)	0.21
Total operation time (minutes)	148 (50-815)	198 (55-765)	125 (48-815)	0.12
Operation time (minutes)	97 (46-283)	148 (55-345)	87 (44-163)	<0.001
Excised BSA% per operation	4.0 (0.0-22.5)	9.0 (1.5-30.0)	3.0 (0.0-13.0)	<0.001
Number of surgeons per operation	2.0 (1.0-3.0)	2.0 (1.0-3.0)	2.0 (1.0-2.8)	0.26
Male sex	118 (70%)	43 (69%)	75 (70%)	0.92

Data are presented as median (10-90 centiles). TBSA% = percentage total body surface area burned. BSA% = percentage body surface area.

the median operation time was shorter in the sequential excision and xenograft group (*Table I*).

Comparison of surgical outcomes

After adjusting for TBSA%, neither duration of stay/TBSA% nor duration of stay/excised BSA% differed between the groups. The first operation was later in the sequential excision and xenograft group (2 days), the number of autografts in the total excision and autograft group was similar to that in the sequential excision and xenograft group with one operation in each group. However, the number of reoperations with autografts in the total excision and autograft group was higher, with 11 more operations (*Table I*).

Duration of stay/TBSA% plotted by TBSA% groups showed a similar biphasic increase in duration of stay/TBSA% for small and larger TBSA% when compared with moderate-sized burns (*Fig. 2*).

Comparison of costs

Median costs were higher in the total excision and autograft group among patients with smaller burns (< 25% TBSA) but there was no difference after adjustment for TBSA% and duration of stay. There was a tendency, although not a significant one, towards higher cost in the sequential excision and xenograft group among patients with TBSA > 25% after adjustment for TBSA% (*Table II*).

Sub-group analysis

In the sub-group analysis of patients with burns < 25% TBSA, smaller TBSA% as well as FTB% was noted in the sequential excision and xenograft group, and a shorter mean operation time, with a 25-minute difference: however, duration of stay/TBSA% showed no differences between the groups (*Table III*).

In patients with > 25% TBSA, there were no differences in TBSA%: median duration of stay/TBSA% was 1.1 and 1.3 for the total excision and autograft and sequential excision and xenograft groups, respectively, and mean operating time was shorter in the sequential excision and xenograft group by 135 minutes (*Table IV*).

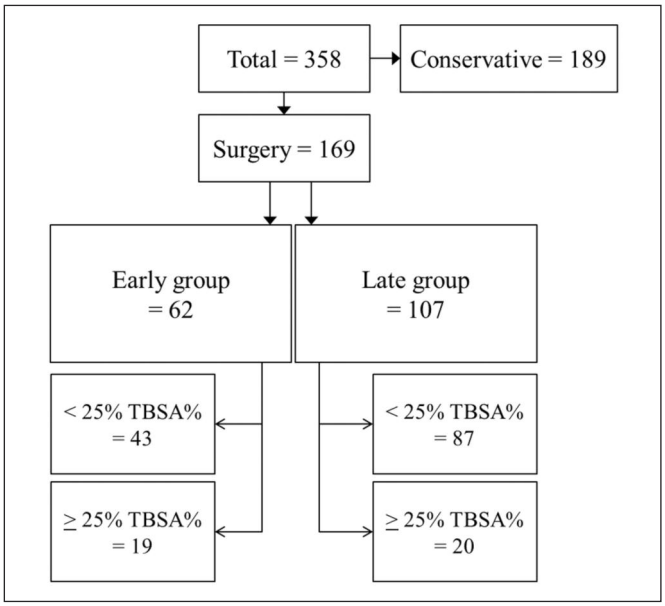

Fig. 1 - Algorithm for selection of patients.

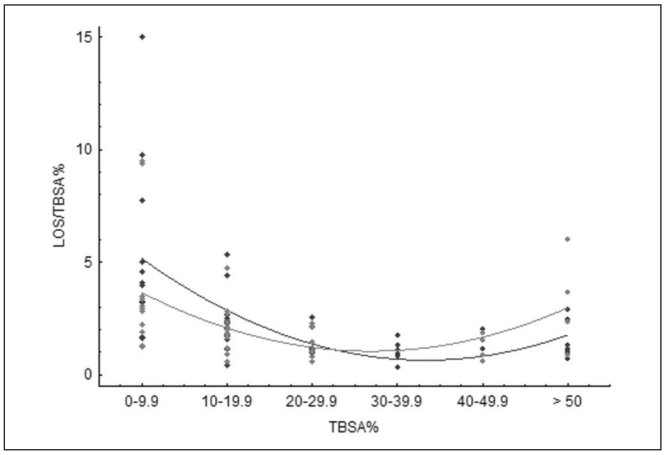

Fig. 2 - Duration of stay/total body surface area burned% by TBSA% groups. Red = xenografts, blue = autografts. Lines are polynomials. LOS = duration of stay in hospital.

Table II - Comparison of billing charges between the early and the late periods by TBSA% group

	TBSA% group < 25%			TBSA% group 25% and over		
	Total excision and autograft	Sequential excisions and xenograft group	p value	Total excision and autograft	Sequential excisions and xenograft group	p value
Patients, n	43	87		19	20	
*Cost per patient	35315 (8284-112050)	22672 (3924-132106)	0.04	153905 (49267-644397)	287973 (50575-1147532)	0.15
*Cost /TBSA%	4155 (2616-13080)	4983 (1710-16912)	0.96	3758 (1642-15856)	5974 (1928-19307)	0.05
*Cost /day	2354 (1557-3893)	2180 (1308-5104)	0.27	4079 (2500-7038)	5208 (2272-8316)	0.13
Data are presented as median (10-90 centiles). *$US adjusted to the monetary value in 2011.						

Table III - Patients with TBSA < 25% who required operation

	All	Total excision and autograft	Sequential excisions and xenograft group	p value
Patients (n)	130	43	87	
Age (year)	45.0 (2.0-74.5)	35.0 (4.0-65.0)	50.0 (2.0-78.0)	0.02
Duration of stay (days)	15.0 (2.0-30.5)	16.0 (3.0-39.0)	14.0 (1.0-30.0)	0.16
First operation day	2.0 (1.0-14.0)	1.0 (1.0-7.0)	4.0 (0.0-15.0)	0.01
Number of operations	1.0 (1.0-3.0)	1.0 (1.0-2.0)	1.0 (1.0-3.0)	0.02
First autograft day	6.0 (1.0-16.0)	1.0 (1.0-7.0)	8.0 (1.0-17.0)	<0.001
Number of autograft operations	1.0 (1.0-2.5)	1.0 (1.0-2.0)	1.0 (1.0-3.0)	0.87
Duration of stay(days)/excised BSA%	3.0 (1.0-8.0)	3.3 (0.9-9.0)	2.4 (1.0-8.0)	0.26
TBSA%	6.0 (1.0-18.5)	9.3 (2.0-19.0)	5.3 (1.0-15.0)	0.03
Superficial and deep dermal BSA%	3.5 (0.0-14.8)	4.0 (0.0-16.0)	2.6 (0.0-13.8)	0.34
Full thickness burns %	1.0 (0.0-9.0)	2.3 (0.0-9.5)	0.5 (0.0-9.0)	0.003
Duration of stay(days)/TBSA%	2.0 (0.8-6.2)	2.0 (0.9-5.3)	2.1 (0.8-7.8)	0.84
Total operating time (minutes)	105 (47-350)	130 (53-390)	100 (45-310)	0.24
Operating time (minutes)	80 (45-181)	100 (53-292)	75 (36-126)	0.003
Excised BSA%/operation	3.0 (0.0-10.0)	4.0 (1.0-16.0)	2.0 (0.0-8.0)	<0.001
Number of surgeons/operation	2.0 (1.0-3.0)	2.0 (1.0-3.0)	2.0 (1.0-2.5)	0.80
Male sex	89 (68%)	28 (65%)	61 (70%)	0.56
Data are presented as median (10-90 centiles). TBSA% = percentage total body surface area burned. BSA% = percentage body surface area				

Table IV - Patients with 25% and over TBSA who required operation

	All	Total excision and autograft	Sequential excisions and xenograft group	p value
Patients (n)	39	19	20	
Age (years)	32.0 (10.0-54.0)	31.0 (9.0-43.0)	43.5 (12.0-66.0)	0.03
Duration of stay (days)	42.0 (14.0-180.0)	37.0 (14.0-158.0)	56.0 (20.0-203.0)	0.19
First operation day	1.0 (0.0-4.0)	1.0 (0.0-3.0)	2.0 (0.5-7.5)	0.08
Number of operations	4.0 (1.0-11.0)	2.0 (1.0-6.0)	5.5 (2.5-14.0)	<0.001
First autograft day	2.0 (1.0-17.0)	1.0 (0.0-3.0)	8.5 (1.5-17.5)	<0.001
Number of autograft operations	3.0 (1.0-8.0)	2.0 (1.0-6.0)	4.0 (1.5-8.0)	0.02
Duration of stay(days)/excised BSA%	1.3 (0.7-2.7)	1.2 (0.4-2.7)	1.6 (0.7-2.8)	0.21
TBSA%	36.5 (26.0-62.5)	34.0 (26.5-64.0)	40.1 (25.8-60.3)	0.88
Superficial and deep dermal BSA%	19.0 (2.0-40.0)	21.5 (3.0-38.5)	13.8 (1.7-41.0)	0.41
Full thickness burns%	22.0 (0.2-51.5)	17.0 (1.0-57.5)	25.0 (0.1-44.0)	0.43
Duration of stay(days)/TBSA%	1.2 (0.5-2.6)	1.1 (0.4-2.6)	1.3 (0.6-3.0)	0.22
Total operating time (minutes)	570 (210-2147)	565 (210-2345)	774 (274-2035)	0.38
Operating time (minutes)	172 (105-365)	285 (147-395)	150 (99-204)	<0.001
Excised BSA%/operation	18.0 (4.5-32.0)	29.0 (15.0-60.0)	14.0 (0.0-19.0)	<0.001
Number of surgeons/operation	2.2 (1.6-3.8)	2.2 (1.6-3.8)	2.2 (1.6-3.3)	0.61
Male sex	29 (74%)	15 (79%)	14 (70%)	0.52
Data are presented as median (10-90 centiles). TBSA% = percentage total body surface area burned. BSA% = percentage body surface area.				

Tables V and *VI* show the reoperations (graft failures) in the total excision and autograft group: 13 patients with TBSA > 25% and 11 patients with TBSA < 25% compared with the sequential excision and xenograft group with planned operations.

Patients managed conservatively

In the patients who were managed conservatively (80 pa-

Table V - Number of patients who had one or more than one operation among those with TBSA of 25% and over

	Total excision and autograft	Sequential excisions and xenograft group	Total
One operation	6	0	6
Two or more	13	20	33
			39

Table VI - Number of patients who had one or more than one operation among those with less than 25% TBSA

	Total excision and autograft	Sequential excisions and xenograft group	Total
One operation	32	44	76
Two or more	11	43	54
			130

Table VII - Patient demographics for those treated conservatively during both periods (early and late)

	All	Early group	Late group	p value
Patients (n)	189	80	109	
Duration of stay (days)	4.0 (1.0-15.0)	6.0 (1.0-25.5)	2.0 (1.0-12.0)	<0.001
TBSA%	5.0 (1.0-18.0)	6.0 (1.0-22.3)	4.8 (0.5-15.0)	0.10
Age (years)	23.0 (1.0-59.0)	26.5 (1.0-64.5)	18.0 (0.5-56.0)	0.01
Duration of stay (days)/ TBSA%	0.8 (0.2-4.0)	1.3 (0.1-6.3)	0.7 (0.2-2.5)	0.006
Male sex (%)	130 (69%)	48 (60%)	82 (75%)	0.03
Data are presented as median (10-90 centiles). The p values correspond to comparison of both time periods.				

tients during the period 1997-98 and 109 patients during the period 2010-11), TBSA% did not differ, but duration of stay/TBSA% decreased by almost a half in the period 2010-11 (*Table VII*).

Discussion

To our knowledge, this is the first study to compare adjusted surgical outcome assessed as duration of stay after early total excision and direct autograft on the one hand, with sequential excisions and temporary coverage using a xenograft to ensure a favourable wound bed before autograft on the other. The most important finding was that the more conservative approach and delayed autograft did not affect adjusted duration of stay in hospital, despite the autograft being delayed for a median (10-90 centiles) of 8 days (1-17 days) compared with the immediate application of autografts.

As anticipated, the favourable effects of this procedure were shorter mean operating time and fewer graft failures compared with the total excision and autograft group. Burns < 25% TBSA had a high rate of reoperations (graft failures) in the total excision and autograft group when we expected to operate on the patient in one session. Because of failed grafts, 11 patients had to be re-operated on and given new skin grafts (*Table VI*), compared with the sequential excision and xenograft group where multiple operations were planned. The drawbacks in the later period were more frequent operations, and a tendency for costs to increase in burns > 25% TBSA.

There are, however, several new and important findings. We think that the results are of general value as they are gathered by a National Burn Centre with well-documented epidemiological data.[17,23] Median TBSA%, age and duration of stay in our study groups were similar to those published previously.[5,24] Both techniques are based on previously published strategies (total excision and autograft[1]) and the sequential approach by Still et al.[5] However, neither of those publications reported both duration of stay/TBSA% and duration of stay/excised BSA% for comparison, and Still et al. did not have a control group, as we did.

Comparisons of outcome

Johnson et al. suggested that the relationship between duration of stay and TBSA% is a linear one, and that duration of stay/TBSA% of 1 is achievable.[25] However, they excluded patients with > 60% TBSA from their calculations, which we think is a shortcoming. Our results support the finding of Engrav et al.[16] that the relationship between duration of stay/TBSA% is better described as non-linear, with increased duration of stay/TBSA% in the low and high ranges of TBSA%.

The absolute values for duration of stay/TBSA% in the groups studied are similar to those presented by Engrav et al.,[16] but higher than those quoted by Still et al.[5] However, in the data presented by Still et al., duration of stay was not adjusted for the operation, and the conservatively-treated patients were also included, a strategy that has recently been claimed to be less than accurate, as duration of stay/TBSA% differs between conservatively-treated and surgically-treated burns.[16]

In contrast to our hypothesis, we did not record any differences in adjusted duration of stay between the two strategies, but the outcome is still comparable to that presented by others.[5,16]

We used billing charges to compare costs between the two groups and found significantly lower costs in the group with < 25% TBSA in the sequential excision and xenograft group. However, after adjustment for TBSA% there were no differences. On the other hand, there was a tendency towards higher cost in the sequential excision and xenograft group with burns > 25% TBSA, which can be related to the use of xenografts. More thorough cost/benefit analyses are needed to explore these differences further.

There was a shorter operating time (which was expected) in the sequential excision and xenograft group. We found no significant difference in duration of stay/TBSA%. These results do not reflect the findings of others,[26] who found that longer operating times and larger TBSA% were associated with longer duration of stay. However, their model was not adjusted for excised BSA%, which we think is a better measure of the extent of operation required for the treatment of a burn. In future, staged excision and delayed autograft may prove to be more cost-effective for larger burns, and traditional early excision with early autograft better for smaller burns. The exact cut-off point in terms of burn surface area for the strategy remains to be elucidated.

The finding of shorter adjusted duration of stay among patients managed conservatively in the late group could have several explanations. First, and most importantly, a more active regimen of outpatient treatment has been implemented recently. Secondly, and of importance for this study, the use of xenografts may facilitate outpatient care because they require fewer changes of dressing and have been claimed to reduce pain.[27] This is also an interesting area for further study.

Limitations

This study has several important limitations. First, the total number of burns included in each group is limited, and it is a single-centre study in a thinly-populated country. This affects the power of the study, and has the potential to miss important

differences between groups.

Secondly, the method is that of a case control study with a historical control group treated more than 10 years ago. This may also influence the results, as burn care has developed over time. However, we must stress that the outcomes presented are in line with more recent data produced by others.[16] The population is also homogeneous, and treatment plans were well-developed and had been in use for a considerable period of time before the study. Thirdly, we used duration of stay as the outcome measure, which has appreciable shortcomings (such as the effects of change in administrative policies and patterns of referral). Lastly, we did not examine other important outcome measures that illustrate different aspects of the outcome of treatment of burns for the patients, such as physical function, scars, return to work, quality of life and health economic issues.[28-31]

Conclusion

The two groups showed no major differences in terms of adjusted duration of stay, but our findings suggest that doing early, smaller sequential excisions using a xenograft for temporary coverage can result in shorter operating times, saving us the trouble of making big excisions. However, there was a tendency to higher costs in the group with burns > 25% TBSA. An incidental finding was that treatment with xenografts in patients with partial thickness burns that did not need operation improved the adjusted duration of stay/TBSA% by almost half compared with silver sulphadiazine dressings alone.

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Conflict of interest. None

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