

The behaviour of presternal scars in a fair-skinned population

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Summary

The incidence of keloid and hypertrophic change and of scar stretching in the presternal region were studied in a fair-skinned population following open heart surgery through a median sternotomy incision. No patient in this study developed keloid change although scar hypertrophy and stretching were frequent. These changes were unrelated to the material used in subcuticular suture of the skin in a comparison of catgut, prolene and polyglycolic acid. Hitherto, unrecognised differences of scar maturation between different areas of the presternal skin were noted to be statistically significant. Scar hypertrophy is most likely in that part of the scar overlying the body of the sternum and particularly in the female. Scar stretching occurs most frequently in the lower third of the scar overlying the xiphisternum and extending onto the abdomen.

Introduction

The susceptibility of presternal scars to hypertrophic and keloid changes is well documented in dark-skinned races (1-3). While true keloid change is rare in the fair-skinned (4), the presternal region is considered the likeliest site for its occurrence (5). The precise incidence of these changes in this and other regions of the body has not been determined in fair-skinned races.

A prospective study of patients undergoing cardiac surgery was undertaken to investigate the maturation of presternal scars in a fair-skinned population. Scars following subcuticular skin closure with three suture materials were examined and compared.

Patients and methods

One hundred consecutive patients undergoing median sternotomy for cardiac surgery were studied. Twelve patients of African, Indian and Mediterranean extraction were excluded. Six patients who required further surgery before 1 year and nine patients who died or were lost to follow-up

before 1 year were also excluded. The effective study population was therefore 73 patients of North European extraction of whom 41 were men and 32 were women, with a mean age of 51 years and an age range of 10-76 years.

A standard technique of chest closure was used:

- 1 Sternum: interrupted 3-gauge monofilament stainless steel wire.
- 2 Presternal fascia: continuous 1-gauge monofilament nylon.
- 3 Subcutaneous tissue: continuous 2-0 polyglycolic acid.

In respect of the material used to suture the skin, the patients were randomly allocated to three groups. In 20 patients, the skin was sutured with subcuticular 3-0 chromic catgut, in 28 patients with subcuticular 3-0 polyglycolic acid and in 25 patients with subcuticular 3-0 prolene. Prolene sutures were removed 8-10 days after surgery. The three groups were well matched for age and sex (Table I).

TABLE I Age and sex of patients

	Catgut (n = 20)	Prolene (n = 25)	Polyglycolic acid (n = 28)
Male patients	12 (60%)	14 (56%)	16 (57%)
Female patients	8 (40%)	11 (44%)	12 (43%)
Age range (years)	10-71	12-69	14-76
Mean age (years)	51.9	49.0	52.7

The male:female ratio of the three groups of patients was compared using Fisher's Exact Probability Test and found to be not significantly different at the 5% level.

The age distribution of the three groups of patients were compared using the χ^2 test and found to be not significantly different at the 5% level.

Postoperatively, the wounds were inspected daily and serous or purulent discharge from the wound noted. The patients were then seen 1 year after surgery.

The scar was analysed in three parts, defined respectively as:

- 1 Upper one-third: that overlying the manubrium of the sternum.
- 2 Middle one-third: that overlying the body of the sternum and lying between the breasts.

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3 Lower one-third: that overlying the xiphisternum and extending onto the abdomen.

The maximum width of each part of the scar was recorded and these measurements grouped as 0–0.25 cm, 0.25–0.5 cm, 0.5–1.0 cm or more than 1.0 cm wide. A subjective estimation of scar hypertrophy was made. To reduce observer variation, one surgeon assessed all the patients at follow-up. The scar was described as 'flat', 'hypertrophied' (slight scar elevation) or 'markedly hypertrophied' (marked scar elevation). The latter group were those in whom the scar was a conspicuous cosmetic defect.

Results

Table II shows the incidence of postoperative wound infections. Analysis of these data by Fisher's exact probability test indicates that the increased incidence of wound infection in wounds closed with catgut when compared with the incidence in wounds closed with prolene or polyglycolic acid does not attain statistical significance at the 5% level.

Tables III and IV show the results of analysis of the scars 1 year after surgery. There is a progressive increase in scar stretching from top to bottom of the sternum, with the same pattern of stretching in the three groups of patients. The upper part of the scar is less than 0.25 cm wide in 66% of cases, whereas the lower part is less than 0.25 cm in only

TABLE II Postoperative wound complications

	Catgut (n = 20)	Prolene (n = 25)	Polyglycolic acid (n = 28)
Wound infections*	3 (15%)	0 (0%)	1 (4%)

*Wound infection is defined as the presence of pus which either discharged spontaneously or needed to be released from the wound (12).

31%. Analysis of Table III by the fitting of a log-linear model (after merging the 0.5–1.0 cm and >1.0 cm patient groups) shows a statistically significant difference in scar stretching between the upper and lower parts of the scar ($P < 0.001$). No suture material showed particular advantage or disadvantage. Widely stretched scars were slightly more common in men (Fig. 1).

No patient developed keloid change of any part of the scar. However, scar hypertrophy was common particularly in the middle third of the scar (Fig. 2). This pattern of hypertrophy was reflected in all three groups of patients with no suture material showing particular advantage or disadvantage. Analysis of Table IV by the fitting of a log-linear model shows a statistically significant difference in the incidence of scar hypertrophy between different parts of the scar ($P < 0.001$), the lower part showing a significantly greater incidence of hypertrophy and the middle part showing a significantly greater incidence of marked hypertrophy than the upper part of the scar. The overall incidence of marked hypertrophy of the middle third of the scar was 37%. The incidence in male patients was 24% and that in females was 53%; analysis by Fisher's exact probability test indicates that this sex difference is statistically significant at the 5% level.

Discussion

In this study of a North European population true keloid change as variously described (4, 6–9) was not seen. Scar hypertrophy was common. Significant regional differences in scar maturation and the particular tendency of scars overlying the body of the sternum to undergo florid hypertrophy have not been reported previously. The predilection of fair-skinned females to develop hypertrophic scars in the presternal region was first noted by Jacobsson in 1940, and is confirmed in this study which shows a statistically greater incidence of scar hypertrophy in the middle part of the scar in females. There is no immediate explanation to these

TABLE III Late assessment of scars: scar stretching

Suture material	Part of scar	Scar width			
		0–0.25 cm	0.25–0.5 cm	0.5–1.0 cm	1.0 cm
Catgut n = 20	Upper	13 (65%)	4 (20%)	3 (15%)	0 (0%)
	Middle	7 (35%)	8 (40%)	5 (25%)	0 (0%)
	Lower	7 (35%)	6 (30%)	7 (35%)	0 (0%)
Prolene n = 25	Upper	14 (56%)	7 (28%)	4 (16%)	0 (0%)
	Middle	7 (28%)	12 (48%)	6 (24%)	0 (0%)
	Lower	7 (28%)	9 (36%)	7 (28%)	2 (8%)
Polyglycolic acid n = 28	Upper	21 (75%)	5 (18%)	2 (7%)	0 (0%)
	Middle	13 (46%)	15 (54%)	0 (0%)	0 (0%)
	Lower	9 (32%)	14 (50%)	5 (18%)	0 (0%)

TABLE IV Late assessment of scars: scar hypertrophy

Suture material	Part of scar	Scar hypertrophy		
		Flat	Hypertrophy	Marked hypertrophy
Catgut n = 20	Upper	18 (90%)	2 (10%)	0 (0%)
	Middle	8 (40%)	8 (40%)	4 (20%)
	Lower	12 (60%)	6 (30%)	2 (10%)
Prolene n = 25	Upper	18 (72%)	5 (25%)	2 (8%)
	Middle	6 (24%)	6 (24%)	13 (52%)
	Lower	13 (52%)	5 (20%)	7 (28%)
Polyglycolic acid n = 28	Upper	21 (75%)	5 (18%)	2 (7%)
	Middle	9 (32%)	9 (32%)	10 (36%)
	Lower	13 (46%)	9 (32%)	6 (22%)

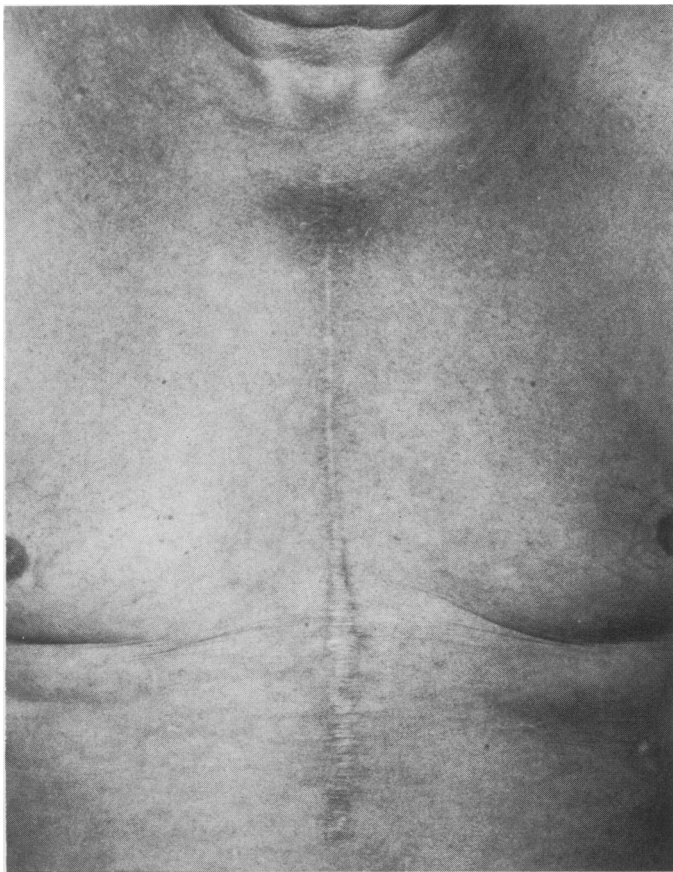


FIG. 1 Medium sternotomy scar in male showing stretching of lower third of scar.

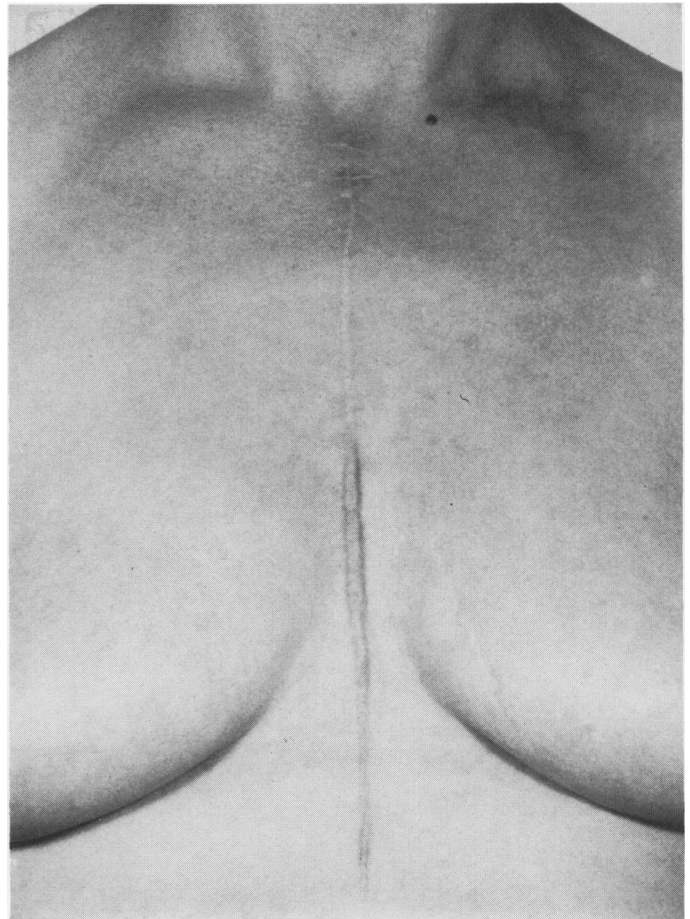


FIG. 2 Medium sternotomy scar in female showing hypertrophy of middle third of scar.

regional and sex differences of scar maturation although chest movement during respiration would be expected to subject different parts of the presternum to different stressing forces. The female breasts might also contribute a lateral force to the middle part of this scar.

Scars overlying the body of the sternum frequently develop a butterfly shape. Whilst the lateral pull of the female breast has been implicated in the formation of the butterfly presternal scar (9), this shape has been shown to occur as commonly in males (4). Butterfly-shaped scars were not seen in this study. The occurrence of keloids with this shape elsewhere on the body (11) and the complete absence of this configuration following subcuticular suture of the presternal skin suggest that this shape may result simply from percutaneous suture of a wound in any region susceptible to hypertrophy and keloid change. Coalescence of a central scar with two adjacent suture hole scars, or hatchmarks, during maturation would form a butterfly-shaped scar.

Hatchmarks are a predictable consequence of percutaneous suture of the median sternotomy incision because the skin stitches must remain *in situ* for at least 8 days to accommodate the tension under which the skin is closed. The hatchmarks suffer the same maturation changes as the midline scar and may result in scarring to a total width several times that of the central scar. This defect is irremediable and, should hypertrophic changes supervene, is a cosmetic disaster. In this study subcuticular suture with three different materials suffered no complications to negate the very obvious advantage of eliminating hatchmarks and their sequelae. This advantage probably pertains to suture of all presternal wounds, favouring the use of the subcuticular technique in this region.

This wound is a suitable model for further studies of wound healing; the median sternotomy incision is the

standard approach to cardiac surgery, is amenable to photography and measurement and heals badly. In this study stretching and hypertrophy occurred consistently with three commonly used suture materials.

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