TISSUE REACTION TO POLYGLYCOLIC ACID SUTURE COMPARED TO MONOFILAMENT NYLON

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SUMMARY

A comparative study on tissue reaction to polyglycolic acid (Dexon), Nylon and Dacrofil suture materials on incised skin wounds was carried out on three healthy East African Short horned goats. The tissue reaction was studied by gross examination and biopsy specimens for histology. The initial tissue reaction in all wounds was basically similar. After two weeks, tissue reaction to nylon and Dacrofil had subsided when compared to that on Dexon. Some cellular infiltration persisted in the wounds sutured with Dexon, particularly neutrophils and macrophages. However, there was substantial fibroblast proliferation, collagen fiber formation and epithelialization which was similar to those on nylon and Dacrofil. This indicates that the intense inflammatory reaction to Dexon is primarily responsible for the absorption of the suture material and interfered minimally with the wound healing process. It is therefore suggested that Dexon can be used as a skin suture material in goats without complications.

INTRODUCTION

A wide variety of suture materials have been used in surgery, their choice depends on many factors such as durability, handling ability, knot security, tensile strength and biological interaction of sutures with tissues involved (Varma *et al.* 1981). Both absorbable and non absorbable sutures have been developed, but an ideal suture to be used in all types of tissues has not yet been developed.

Monofilament Nylon, Dacrofil[1] and other non absorbable sutures are acceptable as skin sutures because they usually elicit a less tissue reaction when compared to absorbable sutures (Postlethwait 1971; Woods *et al.*, 1984).

Polyglycolic acid suture (Dexon[1] is a synthetic absorbable suture material which is widely used for skin wounds in cattle and horses (Hesselhot, 1985). Edlich, 1973, compared the tissue reaction of Dexon and chromic catgut and observed Dexon to initiate less inflammatory response. Based on the low level of inflammatory response, Dexon has been suggested to be a suitable suture material for skin wounds (Larsen, 1978). A comparison of tissue reaction between Dexon and non absorbable sutures is lacking in literature. This paper reports a comparative reaction between Dexon, Nylon and Dacrofil sutures on skin wounds in goats.

MATERIALS AND METHODS

Three healthy male East African short horned goats about 9 months old were used in the study. Three 10 cm long parallel incisions were made on the skin and subcutaneous tissue on both flanks and each was sutured with either Nylon, Dexon or Dacrofil in a simple interrupted pattern. Prior to surgery aseptic procedures were adopted and paravertebral nerve block using 2% lignocaine hydrochloride solution was used for analgesia of the flank. After the operation animals were kept in a clean pen for one month. Skin biopsies about one square centimetre around each suture were harvested from each incision at 3, 10, 14 and 20 days. After the biopsy was taken, wounds were sutured with nylon in a simple interrupted pattern.

The specimens were immediately fixed in 10% buffered formalin and processed according to standard histological methods. About 5 µm thick

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Dacrofil - Registered trade mark B. Braun Melsungen AG - W. Germany
Dexon - Registered trade mark D.G. Davis and GECK - 1.

sections were made and stained with haematoxylin and eosin. The tissue reaction was studied both macroscopically and microscopically. Assessment was made on the basis of inflammatory and wound healing processes.

RESULTS

The gross and histological appearance of the wounds sutured with different sutures is summarised in Tables 1 and 2, respectively.

Table 1: Gross appearance of wounds

Type of Suture material	Day of incision	Line of incision	Gross appearance: Inflammatory signs (swelling)	Gross appearance: Exudate on the wound
Monofilanylon	3	Clearly seen	Present	Blood clots and soft scab
	10	Present	Present (Moderate)	Scar started shedding
	14	Disappearing	Absent	Scar present
	20	Absent	Absent	Scar formed
Dacrofil (Polyster)	3	Clearly seen	Present	Blood clots and soft scab
	10	Present	Present (Moderate)	Scab shedding off
	14	Disappearing	Absent	Scar formed
	20	Absent	Absent	Scar formed
Dexon (PGA)	3	Clearly seen	Present	Blood clots and soft scab
	10	Present	Present	Scab shedding off and clear exudate
	14	Disappearing	Present (Moderate)	Scar formed
	20	Absent	Present around sutures	Scar formed

On day 3 all wounds were covered with a scab and histologically the incision line was visible and infiltrated with erythrocytes and inflammatory cells predominantly neutrophils. There was also marked oedema in the tissues and a few fibroblasts were present. The inflammatory reaction was nearly similar in all wounds.

On day 10, a dried scab covered some areas in all the wounds while in others scab shading had started. Histologically, the line of incision was visible but infiltrated with a lot of fibroblasts, leucocytes and some collagen fibers with new capillaries bridging the gap.

In addition to the above reaction, the Dexon sutured wounds had more intense inflammatory reaction and oedema was more pronounced when compared to the other sutures. Evidence of epithelialization was also observed in some areas in all the sutures.

After 14 days, the scab on all wounds was completely shed off in most parts and was replaced by a scar. Around Dexon sutures clear fluid exudate and dried serum was present.

Histologically in all wounds the gap was bridged by granulation tissue. In wounds sutured with Dexon, granulation tissue was less than that of either nylon or Dacrofil and there still remained some infiltration by inflammatory cells, predominantly neutrophils and macrophages. Dexon suture fibrils were still intact with very minimal absorption and had a good tensile strength. Epithelialization, which was characterised by partially keratinised epithelial cell projections was complete.

On the twentieth day, mature granulation tissue covered the wounds and complete repair of the

Table 2: Histological appearance of wounds

Suture	Day of biopsy	Inflammation around the suture (mm)	Inflammatory cells around the suture			Epithelialisation	Wound size (mm)	Haemorrhage	Oedema	Collagen tissue	Inflammatory cells
			Neutrophils	Macrophages	Fibroblasts						
	3	2.0×10^{-3}	++	+	+	-	5.3×10^{-3}	+++	++	+	+++
Mono-	10	2.0×10^{-3}	+	++	++	+	4.5×10^{-3}	+	+	++	++
filament	14	1.5×10^{-3}	+	++	+++	+	3.5×10^{-3}	-	-	+++	+
Nylon	20	1.0×10^{-3}	-	+	+++	+	3.3×10^{-3}	-	-	+++	+
	3	4.0×10^{-3}	++	+	+	-	5.4×10^{-3}	+++	++	+	+++
Dacrofil	10	4.5×10^{-3}	++	++	++	+	4.5×10^{-3}	++	+	++	++
(Polyster)	14	3.0×10^{-3}	+	++	+++	+	3.8×10^{-3}	+	+	++	++
	20	2.0×10^{-3}	-	+	+++	+	3.8×10^{-3}	-	-	+++	+
	3	3.0×10^{-3}	++	++	+	-	5.3×10^{-3}	+++	+	+	+++
Dexon	10	4.0×10^{-3}	++	++	+	+	5.6×10^{-3}	+	++	++	++
(PGA)	14	4.5×10^{-3}	++	++	+++	+	5.1×10^{-3}	+	++	++	++
	20	3.0×10^{-3}	+	++	++	+	4.8×10^{-3}	-	-	++	++

+++ = High ++ = Moderate + = Low - Absent

incision gap had occurred on all wounds. However, in the Dexon sutured wound, inflammatory cells, particularly neutrophils, macrophages and some fibroblasts were still observed around the sutures. Epithelialization was complete on all wounds and were recognised as scars on the skin. There was no complication associated with the wound healing process. Even after twenty days Dexon sutures were minimally absorbed and still retained some tensile strength.

DISCUSSION

After a surgical incision on the skin, a sequence of cellular activities is started which tries to restore the structural continuity of the injured tissues. Wounds are usually sutured to give them support during early healing. In the first few days the wound is entirely dependant on the suture for strength, degree of cellular activity initiated by suture material is dependant upon the tissues involved.

The observations that the initial tissues reaction to Nylon, Dacrofil and Dexon were the same indicate that these sutures basically cause a similar tissue response during the early phases. After ten to fourteen days it was evident that a more intense inflammatory reaction was present around Dexon suture compared to Nylon and Dacrofil. This supports the view that all sutures show peak reaction in the first week, thereafter the reaction to non absorbable sutures subsides to a minimum, while that to absorbable is greater until absorption is complete (Bilich, 1973; Taylor, 1975; Mbiuki, 1983). Collagen fiber formation was more pronounced around Dacrofil and Nylon, showing that the wounds sutured with these sutures were healing faster. However, similarly the wounds sutured with Dexon had good healing and epithelialization was more or less similar to that observed on the other sutures.

Dexon being an absorbable suture, probably caused more intense inflammatory response in an