NEW APPLIANCES

New Synthetic Absorbable Suture Material

Mr. M. NAUNTON MORGAN, lecturer, Surgical Unit, Westminster Hospital, London S.W.1, writes: A synthetic absorbable suture material made of polyglycolic acid (P.G.A.) has recently been developed. P.G.A. is a homopolymer of glycolic acid and is formed by allowing glycolic acid to form the cyclical ester glycolide, which in the presence of heat and a catalyst is converted to a linear chain polymer of high molecular weight (Fig. 1).

FIG. 1

The resultant polyester is then liquefied and extruded through spinnerets to form continuous filaments from which the sutures are made.

The P.G.A. suture has been extensively investigated in animals, and as a result of these tests has been passed as safe for clinical trial.

Animal work (Davis and Geck, 1968) has shown that the P.G.A. suture is completely absorbed in nine months and exhibits a minimal tissue reaction. Studies with P.G.A. suture labelled with ¹⁴C show that it is excreted mainly in the urine and expired air. This suggests that it had been metabolized to energy, CO₂, and water. Initially the highest tissue concentrations other than that at the implantation site were in the liver and gastrointestinal tract.

The tensile strength of the P.G.A. suture has been compared with other commonly used suture material (Table I) and has been shown to be stronger than catgut, silk, and cotton of comparable diameters.

FIG. 2.—Comparison of strength retention of simultaneously implanted P.G.A. suture and catgut in rabbits.

Strength-retention tests performed in rabbits have shown (Fig. 2) that P.G.A. suture remains stronger over the crucial first 10 days than comparable catgut sutures.

PRESENT STUDY

The P.G.A. sutures were used in 49 patients, whose ages ranged from 21 to 85 years. No woman of child-bearing age was included in this study. The sutures were used in skin, subcutaneous tissues, fascia, and muscle aponeuroses in a variety of combinations, amounts, and suture sizes. Full blood count, urine analysis, alkaline phosphatase, blood urea, serum aspartate aminotransferase, and serum alanine aminotransferase estimations were carried out pre-operatively, on the third to fifth post-operative day, and four to six weeks later as an outpatient.

Sutures were left in for 14 days as an outpatient, as he failed to attend earlier for their removal. All the remaining wounds healed well, there being no evidence of disruption of the aponeurotic layer clinically. Routine tests were normal.

Group 4. Subcuticular Skin Sutures, Fat, and Aponeurosis (9 Patients).—All wounds healed well. There was no induration or oedema due to the subcuticular sutures. Routine laboratory tests were normal.

CLINICAL ASSESSMENT

The P.G.A. suture is extremely strong and easy to handle. It does not fray and does not become slippery when moist. The knots do not slip and more accuracy in their placement is possible than with catgut. Its non-slip properties are such that if the first turn

TABLE I.—Relative Strength of Different Sutures in 000 Package Size

	Diameter		Straight Pull			Knot Pull		
	In.	mm.	lb.	kg.	p.s.i.*	lb.	kg.	p.s.i.*
Catgut ..	0.0125	0.318	6.7	3.03	54,600	3.8	1.72	30,900
P.G.A. ..	0.0100	0.254	6.1	2.76	77,800	3.9	1.76	49,700
Silk ..	0.0104	0.264	5.3	2.40	62,400	3.4	1.54	40,000
Dacron ..	0.0097	0.246	8.5	3.85	115,000	3.7	1.67	50,000
Cotton ..	0.0103	0.261	4.0	1.81	48,000	2.7	1.22	32,400

* p.s.i. = lb./sq. in.

The tensile strength of any suture material is more accurately evaluated on the basis of knot pull strength than on straight pull strength, as breaking most often occurs at the knot (Davis and Geck, 1968).

The sutures were used in a variety of operations, several patients having widespread malignant disease (Table II).

TABLE II

	No. of Cases		No. of Cases
Inguinal hernia	24	Hemicolectomy ..	2
Cholecystectomy	6	Vagotomy and	
Partial gastrectomy	6	pyloroplasty ..	1
Laparotomy ..	4	Rectal prolapse ..	1
Femoral hernia	3	Abdomino-perineal	1
		Bilateral adrenalectomy	1

RESULTS

Group 1. Fat Subcutaneous Tissue (8 Patients).—All wounds healed well. Routine tests as outlined above were all normal. Two patients had a full course of radiotherapy postoperatively, their wounds healing satisfactorily.

Group 2. Skin (19 Patients).—All had interrupted sutures, up to 29 sutures being used. There were two slight wound infections but otherwise minimal skin reaction occurred. Three patients showed a transient rise of the transaminase levels on the third postoperative day, but these had returned to normal in two weeks. The routine laboratory tests were otherwise normal.

Group 3. Skin, Fat, and Aponeurosis (13 Patients).—One patient developed a superficial wound infection which cleared up rapidly on removal of the sutures. His

of the knot is not tied tightly it is often difficult to tighten the suture by pulling harder on the second turn. No suture broke on tying during the trial. It does not, however, pass through tissues quite as smoothly as catgut. The P.G.A. suture becomes harder and less flexible when drying out after being soaked in blood or serum, but its handling properties return to normal after wetting. The P.G.A. suture does not dissolve in any of the commonly used plastic skin dressings, and in no way appeared to be weakened by immersion in one of these preparations.

Its use in subcuticular suturing with its high tensile strength and minimal skin reaction will be of considerable value in units where patients are discharged with skin sutures still present, as it obviates the need for an extra outpatient visit or for a visit to their practitioner for removal of skin sutures.

Its use in intestinal anastomoses is currently being investigated.

I should like to thank the Davis and Geck Division of Cyanamid for the supplies of P.G.A. sutures. The P.G.A. suture material is available only for research projects at present, but it is hoped that it will be available for clinical use in the very near future.

REFERENCE

Davis and Geck (1968). Unpublished data provided by Davis and Geck, Danbury, Connecticut, U.S.A.