ADHESIVE STRAPPING FOR UMBILICAL HERNIA IN INFANTS

CLINICAL TRIAL

BY

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The infantile type of umbilical hernia is a common condition. Its frequency has been estimated as about 1:6 in English babies (Woods, 1953), and 40% of American negro babies are affected (Crump, 1952). While it is a benign condition so far as complications are concerned, strangulation being very rare, it is often a cause of much anxiety on the part of the mother both because of the disfigurement and because various symptoms such as "wind" and "colic" are attributed to it. It is known that almost all these hernias disappear spontaneously during the first few years of life (Browne, 1952; Crump, 1952; Gross, 1953; Woods, 1953), but in spite of this there is a difference of opinion amongst authorities concerning methods of treatment, or indeed whether any treatment is necessary at all. Whereas it is generally agreed that operation should be delayed until it is fairly certain that natural resolution is not going to occur (3 years of age was suggested by Barrington-Ward, 1947), there is little agreement about the advantages of mechanical reduction by the aid of adhesive strapping. Barrington-Ward (1947), Browne (1952), and Gross (1953) stated that adhesive strapping hastens disappearance of the hernia, but Woods (1953) felt that strapping is not only useless but in fact delays natural cure.

This paper is the report of a clinical trial carried out over a period of two and a half years to determine whether the application of adhesive strapping to umbilical hernias affected the natural cure rate.

Method

Only babies who were less than 12 months of age when they were first seen were accepted for the trial, and babies whose hernias had previously been kept efficiently reduced were excluded. (Elastic adhesive plaster and "pennies and binders" were not considered efficient methods of reduction.) Alternate cases were strapped and the others, who were not treated in any way, served as controls.

Only true umbilical hernias were included in the trial. Cases of supra-umbilical or linea alba hernias or babies with cutis navel were excluded. Mongols, cretins, and babies with general muscular hypotonia were also excluded. With some of the smallest hernias it was sometimes difficult to be sure whether a hernia was present or whether there was merely a cutis navel. Hernia was diagnosed only if the protrusion at the umbilicus could be reduced easily by digital pressure and a defect in the linea alba was palpated.

The size of each hernia was measured as accurately as possible from the skin of the abdominal wall to the highest point of protrusion. Protrusions of $\frac{1}{4}$ in. (6 mm.) or less were described as "small" and those of more than $\frac{1}{4}$ in. as "big." The smallest diameter of the oval defect in the linea alba was also measured by comparing its size by palpation with the size of holes of known diameter bored in a wooden gauge.

The method of strapping was that described by Gross (1953), using two pieces of 2-in. (5 cm.) non-elastic plaster and threading a tongue cut in one through a hole cut in the other. The skin was first painted with tincture of benzoin to increase adhesion, and the plasters were applied so that there was a gap between them at the back. An

assistant reduced the hernia by pinching the skin into a vertical fold over the hernia and the plasters were then pulled tight. A strip of 3-in. (7.5-cm.) plaster was then applied on top of the 2-in. (5-cm.) plasters. All cases were strapped for four weeks, although the plasters were changed after two weeks, the reduction of the hernia being maintained while this was done. After four weeks the strapping was removed, but if the hernia was still an appreciable size the strapping was reapplied for a further two weeks and occasionally for another two weeks after that. Thus no case was strapped for more than eight weeks. If, however, only a minimal protrusion was seen when the strapping was removed after four weeks, no further strapping was applied, but the hernia was observed until it disappeared.

Cases used for the final analysis were those in which (1) the hernia had disappeared before 12 months of age—that is, the "successes"; and (2) the hernia had not disappeared by 12 months of age—the "failures."

Results

Of the 100 cases which qualified for the final analysis, 80 were successes and 20 failures; 51 babies had their hernias strapped and 49 served as controls. There were 66 males (34 strapped and 32 controls) and 34 females (17 in each group).

Analysis of Cases Using Measurement of the Hernial Protrusion.—Table I shows the results. Unfortunately the "big" and "small" hernias are not evenly matched in the two groups, but the numbers are large enough to show

TABLE I.—Relationship of Results to Size of Hernial Protrusion (Big = More than $\frac{1}{4}$ in. (6 mm.); Small = $\frac{1}{4}$ in. (6 mm.) or Less)

	Strapped				Control			
	Big		Small		Big		Small	
	No.	%	No.	%	No.	%	No.	%
Total	35		16		21		28	
Resolved by 6 months ..	22	67*	14	87	2	9	21	75
" " 9 " ..	26	79*	16	100	8	38	24	85
" " 12 " ..	28	80	16	100	9	43	27	96
Still present at 12 months	7	20	0	0	12	57	1	4

* Since two babies with big protrusions were still under treatment at 9 months, these percentages of hernias resolved at 6 and 9 months refer to 33 babies who had completed their course of strapping by these ages.

that, whereas the difference in the rate of disappearance of the small hernias in the strapped and control groups was slight, 87% and 75% respectively having resolved by 6 months and 100% and 96% by 12 months of age, the big hernias in the strapped group had a much higher success rate than the controls. At 6 months of age 67% of the strapped group had resolved, whereas only 9% of the control group had done so. At 12 months the figures were 80% and 43% respectively. These figures are statistically highly significant.

Analysis of Cases Using Measurement of the Umbilical Defect.—Table II shows the results in the two groups when analysed in relation to the diameter of the defect. Here the numbers are evenly matched in the strapped and control groups, and they show that the hernias with the small defects tended to resolve slightly quicker than those with

TABLE II.—Relationship of Results to Diameter of Umbilical Defect (Big = More than $\frac{1}{4}$ in. (6 mm.); Small = $\frac{1}{4}$ in. (6 mm.) or Less)

	Strapped				Control			
	Big		Small		Big		Small	
	No.	%	No.	%	No.	%	No.	%
Total	13		38		12		37	
Resolved by 6 months ..	5	42*	31	84*	1	8	22	59
" " 9 " ..	8	67*	34	92*	4	33	28	76
" " 12 " ..	8	62	36	95	5	41	31	84
Still present at 12 months	5	38	2	5	7	59	6	16

* Since two babies, one with a large defect and the other with a small defect, were still under treatment at 9 months these percentages refer to 12 babies with big defects and 37 with small defects who had completed their course of strapping by these ages.

big defects; the latter, however, resolved much more rapidly in the strapped group than in the control. The figures of resolution at 6 months of age, however, where the differences appear to be greatest, are not quite significant statistically. Table III shows the correlation between the size of the protrusion and the size of the defect. It is seen that three-fifths of the big protrusions came through

TABLE III.—*Correlation Between Size of Protrusion and Size of Defect*

Size of Defect	Size of Protrusion	
	Big ($> \frac{1}{4}$ in.)	Small ($\frac{1}{4}$ in. or Less)
Big ($> \frac{1}{4}$ in.) ..	22	3
Small ($\frac{1}{4}$ in. or less) ..	34	41

small defects and all but three of the small protrusions came through small defects. If the results are analysed so that the big protrusions with big defects are compared with the small protrusions with small defects, the results are very similar to those of Table II.

Age of Babies when Hernias were First Strapped.—Table IV shows the ages of the babies when strapping was first applied, and it is seen that most of the hernias were

TABLE IV.—*Relationship of Age at Which Strapping was First Applied to Age of Resolution*

Age in Months:	< 1	1-2	3-6	>6
Total No.:	1	40	8	2
No. resolved by 6 months	0	32	4	—
" " " 9 " " " " " " " "	0	36	6	—
" " " 12 " " " " " " " "	0	37	7	0
No. still present at 12 months ..	1	3	1	2

strapped when they were 1 to 2 months old. Neither of the two babies first strapped when over 6 months of age had resolved by 12 months, and when followed up after 12 months neither had resolved at 14 and 28 months respectively.

"Failures."—There were 20 failures in the two groups. One big hernia in the control group had resolved when seen at 14 months of age. The remaining 19 hernias had not resolved at the time of writing, and Table V shows the

TABLE V.—Ages of the "Failures" When Last Seen

Age in months ..	12-17	18-23	24-29	30-36
No. of cases ..	8	3	7	1

ages of the babies when they were last seen. Of the seven failures in the strapped group, two, as already mentioned, were strapped when over 6 months of age. One other case had a supra-umbilical hernia in addition to the umbilical hernia, and a thin band of fibrous tissue separated the two defects; the umbilical hernia, which had previously been big, became much smaller after it had been strapped for four weeks, but it had not quite gone when the baby was 12 months old, the supra-umbilical hernia showing no alteration in size. One case developed pertussis and another chronic bronchitis after the hernias had almost resolved with strapping, but the severe cough in both cases caused recurrence and further strapping was without effect. In two other cases the maximal protrusion was through the upper edge of the umbilical scar, and the hernias were probably what Browne (1952) has called "semi-umbilical." According to him these have a poor prognosis so far as spontaneous regression is concerned. One other similar baby in the strapped group, however, had resolved by 9 months of age. Three of the failures in the control group also had severe coughs, but the remainder were uncomplicated.

Complications of Strapping.—On the whole the babies in the strapped group tolerated the strapping well. Occasionally a mother would complain that her baby seemed to have discomfort when the strapping was first applied, and in two cases strapping had to be abandoned.

because of excessive discomfort or soreness of the skin. These cases were, of course, excluded from the trial. Of the 51 babies who had strapping applied for four weeks or more, 13 suffered from mild excoriation or skin sepsis.

Discussion

The results of this investigation confirm the belief that umbilical hernias in infants have a great tendency to disappear spontaneously during the first few months of life, but they indicate that the natural cure rate depends upon the size of the hernial protrusion. Table I shows that by the age of 12 months nearly all (96%) untreated small hernias had disappeared, whereas less than half (43%) of the big hernias had resolved by the same age. In Woods's (1953) series of umbilical hernias 93% underwent spontaneous resolution in the first year of life, and she thought that severity did not influence the prognosis.

The results also indicate that adhesive strapping greatly increased the cure rate of the big hernias, but had little or no effect on the small ones. The percentage of successes in the strapped group might have been higher if two of the babies had not developed a severe cough. Woods (1953) pointed out that an umbilical hernia may first appear during pertussis or recur after apparent cure. It will be seen that there was no baby with the usual type of umbilical hernia who did not develop a cough, and whose hernia was strapped before 6 months of age, that was not cured by 12 months. Of the 13 failures in the control group, 3 developed a cough and 10 were uncomplicated.

The results of this clinical trial therefore demonstrate that: (1) If an umbilical hernia in a baby protrudes more than $\frac{1}{4}$ in. (6 mm.) and is efficiently reduced by adhesive strapping for at least four weeks, there is a much greater chance that the hernia will have resolved by 6 or 12 months than if no treatment is given. (2) Strapping after 6 months of age is probably useless. (3) No advantage is to be gained by strapping a hernia which protrudes only $\frac{1}{4}$ in. (6 mm.) or less, and possible skin irritation makes it inadvisable to do so.

The sex ratio of two males to one female in this series of 100 cases of umbilical hernia is unusual, and no similar sex ratio has been found in other series reported in the literature. For instance, Barrington-Ward (1947) wrote that umbilical hernia "is usually found in the female." Gross (1953) recorded a ratio of two females to one male, while Paterson and Gray (1927), Carter (1932), and Crump (1952) recorded an equal sex incidence.

Summary

A clinical trial was conducted to determine the efficacy of adhesive strapping for umbilical hernias in infants.

It was found that, while nearly all untreated umbilical hernias had resolved by 12 months of age if the protrusion was small, if the protrusion was more than $\frac{1}{4}$ in. (6 mm.) in size strapping greatly increased the cure rate. Strapping of big hernias before the baby is 6 months old is advocated.

In this series of 100 cases the proportion of males to females was two to one.

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