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ORIGINAL PAPER

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Assessment of the effect of size of the umbilical ring on the risk of umbilical hernia complication in children

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ABSTRACT

Introduction and aim. Assessment of risk of complications in umbilical hernia is important. The aim of this study was to evaluate the effect of size of the umbilical ring on the risk of complication occurring in umbilical hernia.

Material and methods. This was a prospective study of children who had umbilical hernia repair for symptomatic umbilical hernia. Using Vernier caliper, the umbilical ring diameter (URD) was measured at surgery and the patients were divided into 2 groups. Group A had URD of less than of 15 millimeter (mm) and group B patients had URD of 15 mm and above. The 2 groups were compared.

Results. Thirty two cases were evaluated. Their mean age was 42 months. All the patients had umbilical pain. Twenty six (81.3%) patients had URD of less than 15 mm (group A) whereas 6 (18.7%) patients had URD of greater or equal to 15 mm (group B). Group A patients had a mean URD of 12.1±3.4 mm whereas group B patients had a mean URD of 30.5±5.0 mm (p=0.001).

Conclusion. Children who have URD of less than 15 mm are at a higher risk of developing umbilical hernia complications.

Keywords. complications, diameter, risk

Introduction

Umbilical hernia is a ventral hernia located at the umbilicus and is very common in blacks, both in Africa and rest of the world.[1,2] Umbilical hernia has been reported to occur in 15% of Caucasian children and 85% of black children; it usually closes spontaneously during the early years of life.[1] It is speculated that the increased incidence of umbilical hernia in blacks may be due to inherited physiologic characteristics. Umbilical hernia results from imperfect closure or inherent weakness of the umbilical ring after separation of the umbilical cord.[3,4] Complications occurring in umbilical hernia could be incarceration, obstruction or strangulation of the abdominal viscera, though these complications are rare.[5,6] The content of the umbilical hernia could be preperitoneal fat, omentum or intestine. In developing countries, the most common indication for umbilical hernia repair is complicated umbilical hernia. This in contrast to what is obtainable in developed countries where cosmetic reason is a common indication.[7,8] Surgery for umbilical hernia is umbilical herniorrhaphy with some form of umbilicoplasty. The umbilical ring forms the fascial boundaries of the umbilical hernia and is at this level constriction of the viscera occurs. However, the extent of the umbilical skin protrusion is not indicative of the size of the fascia defect.

Some previous studies have suggested that the size of the umbilical ring affects the risk of complication occurring in umbilical hernia, while some of the studies have not reported any difference in this risk measure.

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Aim

The aim of this study was to evaluate the effect of size of the umbilical ring on the risk of complications occurring in umbilical hernia.

Material and methods

This was a prospective study of pediatric patients who presented to the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH), Enugu with symptomatic umbilical hernia between January 2009 and December 2018. ESUTH is a tertiary hospital located in Enugu, South East Nigeria. The hospital serves the whole of Enugu State, which according to the 2016 estimates of the National Population Commission and Nigerian National Bureau of Statistics, has a population of about 4 million people and a population density of 616.0/km^2. The hospital also receives referrals from its neighboring states. Ethical approval was obtained from the ethics and research committee of ESUTH (ESUTH/CMAC/RA/034/VOL.2/07). Patients who have recurrent umbilical hernia and those who are above 15 years of age were excluded from this study. Patients whose caregivers refused to participate in the study were also excluded.

Pre-operative protocol

Consecutive children, less than 15 years, who presented with symptomatic umbilical hernia were recruited into the study. Patients operated on both electively and emergently were evaluated. On presentation, the patients were clinically evaluated and appropriate investigations done to ascertain fitness for surgery. The procedure is explained to the parents/caregiver and informed consent obtained. At induction of anesthesia, preoperative ceftriaxone was given.

Intra-operative protocol

Access was through a subumbilical curvilinear incision which was deepened to the umbilical fascial ring. The diameter of the umbilical ring was measured using Vernier caliper (made of stainless steel and produced by ESAL medicals) which was sterilized before the surgery. The diameter of the umbilical ring was measured transversely, longitudinally and diagonally. The widest diameter was taken and the measurements were documented in millimeters (mm). At least, two measurements of the diameter of the umbilical ring were made and the average taken. This minimized observer variations. The patients were divided into two groups: Group A represented those whose umbilical ring diameter (URD) was less than 15 mm and group B represented those whose URD was greater or equal to 15 mm. Group A patients were considered to have narrow umbilical ring while Group B patients were considered to have wide umbilical ring. Simple primary suture repair of the umbilical defect was done and the wound closed in layers. Firm dressing was subsequently applied.

Post-operative protocol and follow up

The wound was examined on the seventh post-operative day on out-patient basis. The cases were performed as day cases except children with co-morbidities and those who experienced delayed recovery from anesthesia. The follow up period was for 6 months. The follow-up was done physically and the patients were seen monthly during the follow-up period.

Data collection

The following data were collected: Age of the patient, gender, duration of symptoms before presentation, time interval between presentation and surgery, diameter of the umbilical ring in mm, complications of treatment, duration of hospital stay and outcome of treatment.

Data analysis

Statistical Package for Social Science (SPSS) version 23 (manufactured by IBM Cooperation, Chicago Illinois, USA) was used for data entry and analysis. Data were expressed as percentages, means and standard deviation. Chi square test or student's T test was used to test for significance. P value < 0.05 was considered statistically significant.

Results

Patients' demography

Thirty-five cases of umbilical hernia were repaired during the study period but only 32 patients had complete case records and formed the basis of this report. There were 20 (62.5%) males and 12 (37.5%) females which correspond to a male female ratio of 1.6:1. The ages of the patients ranged from 12 months to 96 months with a mean of 42 months. Seventy five percent of the patients were less than 48 months of age. Details are depicted in Table 1.

Table 1. Demographic profiles of the patients

Parameter	Value
Gender	
Male, n (%)	20 (62.5)
Female, n (%)	12 (37.5)
Mean age of the patients	42 months (range: 12-96)
Mean duration of symptoms	2.1 days (range: 1-4)
Interval from presentation to surgery (irreducible hernias)	1.4 days (range: 1-3)
Mean duration of hospital stay (non-day cases)	1.5 days (range: 1-3)

Clinical and operative findings

All the patients (100%) had abdominal pain at the umbilical area. In addition to pain, 18 (56.2%) patients had vomiting, 10 (31.3%) had constipation and abdominal distension was present in 4 (12.5%) patients. All the pa-

tients were symptomatic. Fifteen (46.9%) patients had reducible symptomatic umbilical hernia; another 17 (53.1%) umbilical hernias were irreducible. Among the irreducible hernias, 2 were strangulated and the omentum was involved. Non-viable omentum was resected. There was no bowel resection.

Umbilical ring diameter (URD)

Twenty six (81.3%) patients had URD of less than 15 mm (group A) whereas 6 (18.7%) patients had URD of greater or equal to 15 mm (group B). Table 2 shows details.

Table 2. Umbilical ring diameters, means, standard deviations and p value

	Group A			Group B	
	Mean	SD[a]	p value	Mean	SD
URDb	12.1 mm	3.4	0.001*	30.5 mm	5.0
Number (%)	26 (81.3%)			6 (18.7%)	

[a]SD=Standard deviation; bURD=Umbilical ring diameter, *statistically significant

Post-operative complications

Complications in the 2 groups of patients are shown in Table 3, p value 0.636.

Table 3. Post-operative complications

Complications	Group A	Group B
None	20	4
Surgical site infection	2	1
Wound breakdown	2	1
Hypertrophied scar	2	0
Total	26	6

Outcome of treatment

Overall, 30 (93.8%) patients did well and were discharged. Two (6.2%) patients signed out, in post-operative period, against medical advice. There was no mortality.

Discussion

Umbilical linea alba is formed by the umbilical aperture through which umbilical herniation occurs. Umbilical hernia sac protrudes through a defect in the umbilical ring due to failure of complete obliteration at the site where the fetal umbilical vessels are joined to the placenta during gestation.[9] Natural history of umbilical hernia is spontaneous closure.[10] However, when umbilical hernia fails to close or becomes symptomatic, there is need for surgical repair.[11] There is a report of omental content of an umbilical hernia as a determinant of the risk of a patient developing complicated umbilical hernia; this is due to adherent nature of the omentum which prevents complete reduction.[12] In the present study, we assessed the risk of umbilical hernia complication with respect to the diameter of the umbilical ring.

The male predominance recorded in the present study is consistent with the report of other series on umbilical hernia.[2,13,14] However, a study done in Jos, Nigeria reported female predominance.[10] The reason for this gender difference is not known. The mean age of our patients tally with the report of some studies but is at variance with the result of others.[5,10,14-16] The differences in sizes of the umbilical ring may explain the discrepancies in the mean ages. Late presentation of our patients is manifested in the 2-day lag period. Poverty and ignorance may be responsible for the late presentation. Mean duration of hospital stay of our patients is unsupported by other studies where umbilical hernia repairs were performed as day cases.[17,18] The length of time a patient stays in the hospital may depend on the extent of the procedure and post-operative status.

The symptoms present in our patients is in line with findings of other studies; pain in the umbilical region been the most consistent.[14,16] The symptoms manifested by the patients at presentation may be related to the time of presentation to the hospital. Our protocol for managing symptomatic umbilical hernia is immediate surgery (emergency) for irreducible umbilical hernia and day case surgery for reducible hernia. This may explain the mean interval of 1.4 days between presentation and surgery for irreducible umbilical hernia.

A statistically significant number of our patients who had surgery for symptomatic umbilical hernia had umbilical ring diameter of less than 15 mm. A study also reported that patients with small umbilical fascial defects (5 to 15 mm in diameter) are more prone to incarceration.[9] One study performed at Mayo clinic, Rochester, USA reported that complications in umbilical hernias are more likely in smaller defects.[15] However, other studies on umbilical hernia reported increased incidence of incarceration in children whose umbilical ring diameter were more than 15 mm.[5,10,14] The reason for the increased incidence of umbilical hernia complications in narrow URD may be explained by the mechanism of hernia incarceration: When intra-abdominal pressure increases, like when the child cries, contents of the hernia are squeezed through a narrow hernia neck into the hernia sac. The subsequent recoil of the hernia neck entraps the contents of the hernia preventing the contents from returning into the abdomen and thus incarceration occurs.[19] The above mechanism of incarceration may not happen when the neck of the hernia is wide. A study done in Senegal reported that the main factors contributing to incarceration of umbilical hernia was age of the child and size of the umbilical defect.[20] The exact reason for the differences in the findings of the different studies is not known.

The post-operative complications recorded in the present study is comparable to the reports of other studies.[4,5] However, the post-operative complications were not statistically significant between the 2 groups of patients in the present study.

During the 6 months follow up period, 2 patients in group A developed an abnormal scar that required plastic surgical review. Komlatse et al in their series also reported abnormal scar following umbilical hernia repair.[21] One study reported hematoma and seroma formation as post-operative complications following umbilical hernia repair.[15] Firm dressing which helps in obliterating dead space assists in preventing hematoma and seroma formation. None of our patients had umbilical hernia recurrence.

Most of our patients did well and were discharged home. Other studies also documented good outcomes following repair of the umbilical hernia.[4,5,21]

Recommendation and limitations of the study

Umbilical hernias with smaller diameters should be repaired early to avoid complications.

Although this was a prospective study, it was limited by the small number of cases. A larger number of cases would have availed better analysis. This study was a single institution experience which may not be generalizable to other institutions and other countries.

Conclusion

Umbilical hernia is a common condition particularly in black children. Children who have URD of less than 15 mm are at a higher risk of developing umbilical hernia complications. Early repair of umbilical hernia with narrow URD is therefore recommended.

Declarations

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Author contributions

Conceptualization, C.K.E, ETC; Methodology, C.K.E, ETC; Software, C.K.E.; Validation, C.K.E.; Formal Analysis, C.K.E.; Investigation, C.K, E, ETC.; Resources, C.K.E, ETC.; Data Curation, C.K.E, ETC; Writing – Original Draft Preparation, C.K.E.; Writing – Review & Editing, C.K.E, ETC.; Visualization, C.K.E.; Supervision, C.K.E.; Project Administration, C.K.E, ETC.; Funding Acquisition, C.K.E.

Conflicts of interest

The authors declare no conflict of interest.

Data availability

Data is available and can be provided on proper request.

Ethics approval

Ethical approval was obtained from the ethics and research committee of ESUTH (ESUTH/CMAC/RA/034/VOL.2/07)

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