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A Systematic Review of Current Consensus on Timing of Operative Repair Versus Spontaneous Closure for Asymptomatic Umbilical Hernias in Pediatric

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ABSTRACT

Introduction: Umbilical hernia is a common pediatric disorder that pediatric surgeons are usually asked to manage. Most cases will be closed spontaneously during the first 4-5 years of life. Low number of studies regarding umbilical defects in children does not allow a definitive guideline to be drawn about their natural history, indications and optimal timing for repair. In this systematic review, we evaluated the existing literature where pediatric umbilical hernias are addressed in regards to watchful waiting versus recommendations on timing of operative repair and we compared our institutional results with current literature. **Aim:** The aim of our study is to review and evaluate the current guidelines in management of umbilical hernias in children and to compare the results with our experience in management of umbilical hernia in our institution. **Methods:** Online literature search for studies that published about umbilical hernias in pediatric using literature's search of ACP Journal Club, Clinical Evidence, Dynamed, Cochran Controlled Trial Register (1945-2015), UpToDate, and PubMed. We reviewed the recommendations of these studies regarding conservative treatment, rule and time of surgery, complications, and its natural history trend to close spontaneously. We compared the literature results and recommendations to our institutional results. We also conducted a retrospective medical charts review of 520 children aged between 1 month and 14 years presented to our institution for surgical consultation for asymptomatic umbilical hernia between 2007 and 2017. We only included children with umbilical hernia who are less than 14 years old and without other associated disorders. **Results:** A Total of 7 studies that met the inclusion criteria were reviewed. These studies examined the possibilities of spontaneous closure of hernia defect in pediatric, incidence of complications from watchful waiting and current recommendations for surgery timing. In general, spontaneous resolution were unlikely to be seen beyond the age of 5 years. Our institutional results found that of 442 cases treated conservatively between 2007 and 2017, 85% are closed spontaneously by 1-5 years of age. **Conclusion:** There is minimal top-notch clinical data guiding pediatric surgeons on management protocols in regards to umbilical hernias in children. Current published studies and our institutional retrospective study recommend that conservative management of asymptomatic, uncomplicated umbilical hernias until age 4-5 years is both safe and practical. **Keywords:** Umbilical hernia, spontaneous closure, Herniorrhaphy, watchful waiting, spontaneous resolution.

1. INTRODUCTION

Umbilical Hernia in pediatric age group is very a common finding (1). The incidence of umbilical hernia is affected with age, race, gestational age, and coexisting disorders. In the USA, they found that the incidence is higher in African children from birth to 1-year-old ranges from 25-58%, whereas Caucasian children in the same age group have an incidence of 2-18.5% (2, 3)

After birth, closure of the umbilical defect is due to a complex interactions of lateral body wall folding in a medial direction, fusion of the rectus abdominis muscles into the linea alba, and umbilical orifice contraction which is aided by elastic fibers from the obliterated umbilical arteries. Fibrous proliferation of surrounding lateral connective tissue plates may also help with natural closure. Failure of these closure processes results in umbilical hernia (4)

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Umbilical hernia is usually disappears spontaneously. Surgical repair is not performed because the complications of this condition are rare and the majority of the defects close within 4-5 years; more than 90% close before the child is 6 years of age (5, 6).

Although umbilical hernias in pediatric are common as stated previously, there is a paucity of hard evidence and no current existing standard guidelines for their management. The reason behind this, thought to be the straightforward repair with no significant challenges and secondly, the minimal complications of watchful waiting protocol due to their nature of spontaneous resolution.

For the aforementioned reasons, we have reviewed thoroughly the existing literature on conservative management of umbilical hernia, complications associated with conservative treatment, incidence of spontaneous closure, and recommendations on timing of surgical repair. We also, retrospectively reviewed the medical records of 520 child diagnosed with umbilical hernia in our institution and compared the results of their spontaneous closure with the literature outcomes.

2. AIM

In this study, we aimed to review the literature and the published guidelines in regards to management of umbilical hernias in children. Conservative versus surgical repair and proper time of surgery are the main points of interest. We compared the found literature results to our institutional results of a retrospective study conducted at our institution.

3. METHODS

An online literature's search of ACP Journal Club, Clinical Evidence, Dynamed, Cochrane Controlled Trial Register (1945-2015), UpToDate, and PubMed was done. Only articles published in English were reviewed. Inclusion criteria comprised publications where pediatric umbilical hernias, surgical repair indications, age of surgery and natural history of spontaneous closure are addressed. Data from statistically significant and not statistically significant were included in this review. None of the authors has interests in favor of one publication over the others. Methods of the analysis and inclusion criteria were specified in advance and documented in a protocol. We used the following search terms to search all trials registers and databases, umbilical hernia, children, pediatric, spontaneous closure, surgical repair, recurrence, age of spontaneous closure, randomized controlled trials, controlled-clinical-trials, clinical-trials, random allocation. We excluded studies examining children older than 14 years because our hospital treats only children less than 14 years of age, we also excluded umbilical hernias associated with other pathologies, medical comorbidities such as cirrhosis, renal failure or ascites, and cases of gastroschisis or omphalocele. We developed a data extraction sheet, pilot-tested it on seven randomly-selected included studies, and refined it accordingly. One review author extracted the data from included studies and the second author checked the extracted data. Disagreements were resolved by discussion

between the two review authors; if no agreement could be reached, it was planned a third author would decide. We then summarized the results of these publications and their recommendations and then we have drawn a conclusion of their consensus. The mean and percentage of children whom their umbilical hernia was closed spontaneously before the age of 6 was the primary measure of treatment effect. We assessed the possibility of publication bias by evaluating a funnel plot of the trial mean differences for asymmetry, which can result from the non-publication of small trials with negative results. We acknowledge that other factors, such as differences in trial quality or true study heterogeneity, could produce asymmetry in funnel plots.

Additionally, we performed our own single institutional retrospective study in Amman, Jordan. Electronic and paper-based medical records of 520 children presented to both outpatient offices and emergency department between 2007 and 2017, aged between 1 month and 14 years old were reviewed. The chief complain was painless umbilical swelling which was diagnosed by our faculties as an asymptomatic umbilical hernia. Size of the umbilical defects was not included in the study. Our goal was to identify the percentage of spontaneous closure within the first 5 years of age versus the rate of operatively repaired hernias beyond this age.

4. RESULTS

A total of seven studies were identified for inclusion in the review (summarized in Table 1). The search of ACP Journal Club, Clinical Evidence, Dynamed, Cochrane Controlled Trial Register (196-2015), UpToDate, and PubMed databases provided a total of 284 citations. After adjusting for duplicates 209 remained. Of these, 186 studies were discarded because after reviewing the abstracts it appeared that these papers clearly did not meet the criteria. The full text of the remaining 23 citations was examined in more detail. It appeared that 16 studies did not meet the inclusion criteria as described. Seven studies met the inclusion criteria and were included in the systematic review. No unpublished relevant studies were obtained. The reviewed studies are 5 prospective studies, 1 retrospective study, and one cross-sectional observational study.

In 1953 Woods reported a series of two hundred and eighty-three cases with umbilical hernia where successful conservative treatment was 93% during first year of life without any procedures, also he mentioned that most of cases was diagnosed within the first six months of life. (7)

Mack reported in 1945 that 90% of umbilical hernias healed conservatively in African children who was included in his prospective study on 720 patients with a continual curve of healing from infancy till puberty (8).

Heifetz reported in his prospective study on 78 patients in 1963 a rate of 92.3% of spontaneous closure in umbilical hernias with a diameter more than 0.5 cm. He mentioned that the incidence of spontaneous closure increase with age, and also he reported that the diameter

Author	Publication Year	Type of Study	Results
Mack	1945	-Prospective cohort study -720 patients	90% of hernias closed spontaneously
Woods	1953	-Retrospective cohort study -283 patients	- 93% successful in the first year of life. - No episodes of strangulation or incarceration
Heifetz	1963	-Prospective cohort study -78 patients	92.3%
Walker	1967	-Prospective cohort study -426 patients	89.1% of hernias closed spontaneously by age 6
Blumberg	1980	-Prospective cohort study -1815 patients	- Hernias tend to close spontaneously between age 3 and 4 without any relation to the size - No complicated umbilical hernias noted
Hall	1981	-Cross-sectional observational study -665 patients	Half of hernias present at age 4-5 spontaneously closed by age of 11
Yanagisawa	2015	-Prospective cohort study -89 patients	91% of umbilical hernias with adhesive strapping closed in 13 weeks
Our authors	Not yet	-Retrospective cohort study -520 patients	85% of hernias closed spontaneously by age of 5

Table 1. Rate of umbilical hernias spontaneous closure in children

of umbilical defect decrease over the first year of life by an 18% per month (9).

Hall found in his Cross-sectional observational study on 665 patients that umbilical hernias decrease by half at the age of 11 years in comparison to the age of 4-5 years supporting the fact of spontaneous closure of umbilical hernia in the late ages of childhood (10).

In 1980 Blumberg reported in his Prospective cohort study on 1815 patients over south African children a decrease incidence of umbilical hernia till the age of 3-4 years of life and this fact encourage the conservative treatment of umbilical hernia without surgery (11).

Walker reported on 1967 in his prospective study of 426 patients a successful rate of 89.1% without surgery till 6 years of life. But he documented that larges defect need repair. He reported that 95% of cases with a defect < 0.5 cm in infancy closed spontaneously compared to 100% of hernias with a defect >1.5 cm in infancy treated with surgery after failure of conservative treatment (12).

In 2015, Yanagisawa reported a successful rate of 91% after using umbilical strapping over 13 weeks in an 89 children with a recurrence rate of 2.25%. He say that there was no relation between his results with hernia defect size, or the timing of treatment (13).

Our retrospective study of 520 children aged between 1 month and 14 years presented between 2007 and 2017 with umbilical hernia in Amman, Jordan resulted in that 442 were treated non-operatively and 78 children undergone straightforward surgical repair. Of the 442 cases treated conservatively, 85% closed spontaneously by 1-5 years old irrespective of the defect size upon their presentation. Majority of spontaneous closure was during the first 3 years of life. No incarceration or strangulation were identified.

The final recommendations are most of children with umbilical hernias cured without any operative intervention before the age of 5 years. The major complication associated with observation is the possibility of incarceration or strangulation. Studies have shown very rare complications, with an incidence of less than 0.2%. Also, these studies found that methods like compression

dressings or using devices to keep the hernia reduced do not encourage the closure process and may result in skin irritation and breakdown.

5. DISCUSSION

There is no clear recommendations available on literature regarding the rule or time of surgical repair for asymptomatic umbilical hernias in pediatric age group. In contrast to complicated or symptomatic hernias where an immediate repair is frankly recommended.

While reviewing the literature, we found there is a strong consensus that umbilical hernias in pediatric age groups have the predisposition to close spontaneously especially during the first 3 years of life unlike hernias in adult. Our own retrospective cohort study has also the same conclusions.

This natural history of spontaneous closure of umbilical hernias in pediatric has the advantage of avoiding unnecessary operations, and complications of anesthesia and surgeries. This natural trend is also cost effective to health care facilities.

There is no agreement or clear guidelines for timing of surgical repair for asymptomatic umbilical hernias at pediatric age group. Most of studies in our review advice a conservative management till the age of five without any obvious complications (14, 15).

The majority of recommendations are supporting the watchful waiting over surgical repair for asymptomatic umbilical hernias in children younger than 5 years old. There was no association between size of the defect and incidence of strangulation or incarceration. Some studies showed the possibility of spontaneous closure in later childhood ages regarding larger defects.

Although randomization was adequate in all trials; the main limitation of this review, is that the patient population, and the outcome definitions are not the same across studies. Couple of articles however, did not explicitly state that analysis of data adhered to the intention-to-treat principle, which could lead to overestimation of treatment effect in these trials.

Publication bias might account for some of the effect we observed. Smaller trials are, in general, analyzed with less methodological rigor than larger studies.

6. CONCLUSION

Asymptomatic umbilical hernias in pediatric are a common pathology that encountered by most of pediatric and many general surgeons in their outpatient offices or in emergency department. Little recommendations were found in literature in regards to timing of surgical repair since the vast majority are resolved spontaneously with very minimal complications on watchful waiting strategy.

We concluded from the reviewed studies and additionally we found from our own experience based on our retrospective study, that no surgical repair is indicated for asymptomatic umbilical hernias in infants and children before the age of 4-5 years irrespective of the defect size. In contrast to symptomatic or complicated hernias, where an immediate measurements should be taken in place, this including an operative repair. This guidelines would be of benefits to avoid complications of surgical repair and complications from anesthesia, lessen the burden on medical staff and hospitals and, it is cost effective for health care systems.

- **Author's contribution:** W.A., A.A. and A.O. gave substantial contribution to the conception or design of the work and in the acquisition, analysis and interpretation of data for the work. W.A., M.M.A. and B.A. had role in drafting the work and revising it critically for important intellectual content. W.A., A.A., M.M.A., B.A. and A.O. gave final approval of the version to be published and they agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved..
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