



HERNIA SAC NECK RATIO - A TOOL TO PREDICT THE DEVELOPMENT OF SYMPTOMS AND COMPLICATIONS IN UMBILICAL HERNIA

General Surgery

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ABSTRACT

BACKGROUND: An umbilical hernia with a narrow neck and a wide sac is more prone to complications, thus the morphology of an umbilical hernia is crucial in determining the development of symptoms and consequences. The hernia sac-neck ratio and ultrasonographic findings are used in this study to take into account the physical properties of the hernia in order to anticipate the onset of symptoms and complications. **MATERIALS AND METHODS:** This study is a prospective observational study conducted in Victoria Hospital from February 2021 to July 2022. A total of 115 patients with umbilical hernia underwent an ultrasound of abdomen to note the size of the neck of the hernia. The diameter of the hernia sac was measured clinically for both emergency and elective patients intra-operatively. The ratio was calculated and compared. **RESULTS:** The 115 research participants included 52 complicated cases and 63 uncomplicated cases. The mean hernia neck size in complicated case was 2.07 cm and in uncomplicated group was 2.53 cm. According to the ROC curve analysis, the mean hernia sac neck ratio, the study's area of interest, was higher in the complicated group than in the uncomplicated group (2.78 vs. 2.42) and was linked with a 49% sensitivity and 70% specificity at a cutoff ratio of 2.6. **CONCLUSION:** This study showed that the Hernia sac neck can be used as a specific tool for predicting complications and that individuals with a smaller neck and a bigger sac are more likely to have complications.

KEYWORDS

Umbilical hernia, Sac neck ratio, hernia neck, Sac size, hernia complications.

INTRODUCTION

A ventral hernia is defined by the protrusion of a viscus through the anterior abdominal wall fascia. The European Hernia Society classification for abdominal wall hernias defines the umbilical hernia is located from 3 cm above to 3 cm below the umbilicus.[1] It accounts for 6%-14% of all abdominal wall hernias in adults.[2,3]

When no significant co-morbid diseases are present, the existence of a ventral hernia is itself a sign that the hernia should be repaired. Herniation at the umbilicus has both components, i.e. weakness due to structures passing through the abdominal wall in fetal life and developmental failure of closure. These defects can be categorized as spontaneous or acquired or by their location on the abdominal wall.

Umbilical hernias may be brought on by chronic abdominal wall distension with increased intra-abdominal pressure, such as pregnancy, patients with ascites or peritoneal dialysis, stretching of the abdominal muscle fibres, and connective tissue weakening. [4] Umbilical hernia occurs in around 20% of cirrhotic individuals as a result of increased abdominal pressure brought on by ascites, dilated umbilical veins, and weakening of the muscles or connective tissues as a result of inadequate nutrition.

Adult umbilical hernias are typically easy to diagnose. Reduction of big hernias is frequently difficult because the omentum adheres to the sac. Additionally, there are frequently many fascial defects if the hernia has been present for a long time. The hernia tends to pull downward as it grows larger and takes on an oval shape. These hernias are very symptomatic.

Patients complain of localised dragging pain from the lesion's weight, gastrointestinal symptoms from tension on the stomach or transverse colon, and sporadic colicky pain from partial intestinal obstruction. Incarcerated umbilical hernia are those that have undergone repeated episodes of irreducibility and strangulation. The primary reasons for elective ventral and incisional hernia repair are to treat symptoms and avoid incarceration of the hernia, which would strangle the intestine. The exact number of ventral hernias that lead to incarceration is unknown, however it is assumed that 10% of all cases do.

At present there is no reliable factors to identify patients at risk for complications which would facilitate selection for preventive surgical repair. Independent risk factors for emergency umbilical/ incisional hernia surgery is reported to be female gender, older age and hernia defects between 2-7 cm.[5] It has also been reported that relatively small size of abdominal wall defect can lead to incarceration. Hence

there is a need for reliable parameter to support decision making in patients with umbilical hernia.

METHODOLOGY

A prospective observational study conducted from February 2021 to July 2022 in Victoria Hospital and hospitals attached to Bangalore Medical College and Research Institute, Bangalore.

Taking sensitivity as 90% and precision as 10%, the sample size is taken as 115 with convenient sampling.

Inclusion criteria:

- Patients fulfilling following criteria are included
- Patient of either sex aged between 18 to 60 years.
 - Patient presenting with umbilical hernia.
 - Patient willing to give written informed consent.

Exclusion criteria:

- Patient with congenital umbilical hernia.
- Patients not willing to give written informed consent.
- Patients undergoing hernia repair combined with another intervention.

After obtaining the institutional ethical committee clearance and written informed consent, the inpatients in the department of general surgery fulfilling the inclusion and exclusion criteria were enrolled in the study. Cases who satisfied the inclusion criteria were included and detailed history and clinical examination carried out. A preoperative ultrasonographic examination was performed to note the size of the neck of the hernia. The diameter of the hernia sac was measured clinically using a divider. Hernia sac size was divided by hernia neck size to derive Hernia sac neck ratio.

Statistical analysis will be carried out on the following collected data.

- Calculating the Hernia sac neck ratio for all the cases.
- Calculating mean and median hernia neck size for all patients.
- Calculating Standard deviation of the hernia neck size among the patients presenting with complications.
- Finding a new cut-off in the hernia sac neck ratio in predicting development of complications.
- The sensitivity and specificity of the hernia neck ratio in predicting the development of symptoms and complications.

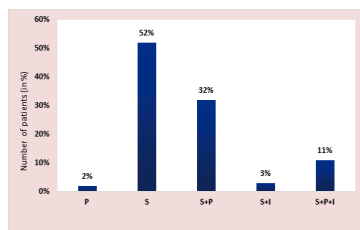
Statistical analysis

Data analysis was done using mean, median, mode, standard deviation, Inter quartile range and proportions. Software used SPSS22 and STATA 11.2 (College station TX USA).

Students Independent sample t-test were used to find the significance difference between the neck size, sac neck and sac neck ratio with complications (Present or absent) and was expressed as mean and standard deviation. Inferential statistics will be done using area under curve with 95% Confidence interval and Receiver Operator Characteristic curve. Sensitivity, specificity will be measured with 95% confidence interval. Mann Whitney U test and independent t test used. Ap value of <0.05 was considered statistically significant.

RESULTS

Out of 115 patients in our study, 49 (43%) patients were male and 66 (57%) patients were females. Only swelling is the most common presenting feature of patients with umbilical hernia in this study at 52%. Out of 115 patients, majority i.e., 71 patients contain omentum as contents, 5 patients contain only bowel, with most common being the small intestine (i.e., 4 out of 5) and large bowel being the content in one case. The sac size is comparable in both complicated and uncomplicated cases with mean sac size in complicated cases being 5.22cm and in uncomplicated cases being 5.59cm. There is significant difference in the hernia neck size with a mean of 2.07cm in complicated cases and 2.53 in uncomplicated cases. The ratio of hernia sac neck was significantly more in the complicated group with a value of 2.78 when compared to the value of 2.42 in uncomplicated group.



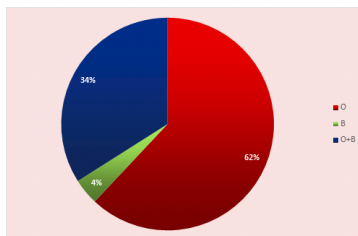
Symptoms Key:

P= Pain

S= Swelling

I= Irreducible

FIGURE 1: Graph showing frequency of patients showing different presentation of umbilical hernia



Key:

O= Omentum

B= Bowel

O+B= Omentum + Bowel

FIGURE 2 : Graph showing frequency of different content of umbilical hernia sac

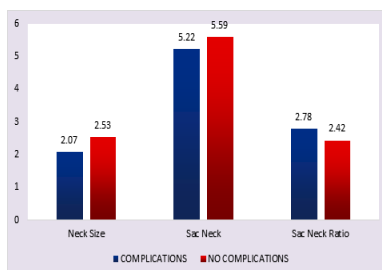
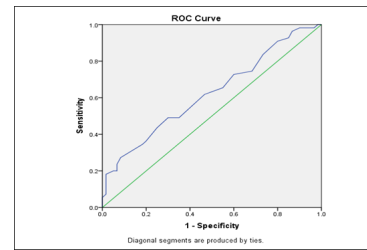


FIGURE 3 : Comparison of mean values of hernia sac measurements

	Complications	No Complications	P-Value
	Mean ± SD	Mean ± SD	
Neck Size (cm)	2.07 ± 0.92	2.53 ± 1.5	
Sac Size (cm)	5.22 ± 1.48	5.59 ± 2.14	
Sac Neck Ratio	2.78 ± 0.81	2.42 ± 0.56	0.006

FIGURE 4: Graph showing mean values of hernia sac, hernia neck and hernia sac neck ratio

FIGURE 5: Comparison of hernia sac neck ratio in complicated and uncomplicated cases



	COMPLICATIONS	N	Mean	Std. Deviation	Std. Error Mean	P-VALUE
SAC NECK RATIO	NO	60	2.415	0.5623	0.0726	0.006*
	YES	55	2.776	0.8147	0.1099	

DISCUSSION

Umbilical hernia is a common problem faced by primary health care providers and surgeons all over the world. Estimated about 25% of individuals are either born with or will develop a umbilical hernia in their lifetime. Even though it is more of an elective procedure, emergency hernia repair does happen and is a known risk factor for increased morbidity and mortality compared to elective hernia repair. Hence there is need for identifying preoperative factors that are associated with high risk of hernia complications as well as emergency repair. One such risk factor, the hernia sac to neck ratio, the ratio of hernia sac diameter to fascial defect diameter was found to be closely associated with complications related to umbilical hernia.

In our study of 115 patients, 55 (47%) patients had complications such as obstruction, irreducibility and strangulation while rest 60 (52%) patients had no complications. The mean sac size in the complicated group was 5.22 and in the uncomplicated group was 5.59. The neck size in the complicated group was 2.07 and uncomplicated group was 2.53 which though not statistically significant shows that the neck size in the complicated group was considerably lower than in the uncomplicated group.

The mean hernia sac neck ratio in this study was found to be 2.78 in complicated group which was much more than that of the uncomplicated group at 2.42 with a P value of <0.05 which is statistically significant.

In this retrospective cohort study conducted by Fueter et al., 106 adult patients with elective and emergent umbilical hernia repair operated from January 2004 to december 2013, the hernia sac size and size of the neck were measured. Out of 106 who were operated for umbilical hernia repair 70 patients were uncomplicated and 36 were complicated. The median size of the hernia sac was statistically significantly smaller in the uncomplicated group. The median size of the neck was not different between both groups. The median HNR was smaller in the uncomplicated group. Based on ROC curve analysis, a cut-off value of 2.5 was associated with 91% sensitivity and 84% specificity. These results suggest that umbilical hernia with HNR >2.5 should be operated, irrespective of the presence of symptoms. [6]

Madhu CP et al, in 2019 conducted a observational study in 50 adult patients, to predict the role of hernia sac neck ratio in predicting the development of symptoms and complications of umbilical hernia. Out of the 50 patients in the study 40 were complicated and 10 uncomplicated. the mean hernia neck size in the complicated group was 2.02 cm with a p-value of 0.091 compared to uncomplicated group which is 2.95 cm. The mean hernia sac neck ratio which is the area of interest in this study was more in the complicated group at 2.97 and much lesser in the uncomplicated group at 2.02 and based on the ROC curve analysis at cut off ratio of 2.2 was associated with a 90% sensitivity and a 70% specificity. This study concluded that patients with a smaller neck and a larger sac are more prone to develop complications and the hernia sac neck ratio can be used as a sensitive tool in predicting the same. [7]

In a retrospective study conducted by Tayler J James et al., a total of 166 patients were included with 84 (51%) required emergent hernia repair and 82 (49%) did not undergo repair. Median follow-up was 19 (8–27) months. This study used preoperative CT scan to measure the

size of hernia sac and neck. There was no statistical significance in the mean size of hernia sac between the group, with emergent group being 5.8cm and group which didn't undergo repair being 6.1cm. However the hernia neck size was significantly smaller in the emergent repair group (1.5 [2.3–3.5] cm vs. 3.4 [1.8–6.2] cm, $p < 0.01$). Hernia-to-neck ratio was significantly higher in the emergent repair group 2.4 vs. 1.7, $p < 0.01$). This study demonstrated an association between higher HNR and increased risk of emergent ventral hernia repair.[8]

In our study we found that the size of hernia sac size and neck size for both complicated and uncomplicated patients were comparable. The hernia sac neck ratio was significantly higher in patients requiring emergent umbilical hernia repair. The sensitivity and specificity of the sac neck ratio based on ROC curve analysis was 49.1% percent and 70% percent respectively with a cut off of >2.6 . This shows that if the hernia sac neck ratio is more than 2.6 in an umbilical hernia then, the chances of it being complicated is higher.

CONCLUSION

With our study, we had equal preponderance of umbilical hernia in both male and female with the most common presenting feature patients with umbilical hernia being swelling (52%) in umbilical region. The most common content of the hernia sac was omentum; with 62% out of with 46% being complicated. The mean neck size was smaller in the complicated group compared to uncomplicated. We demonstrated that higher sac neck ratio is associated with need emergent hernia repair. The sensitivity and specificity of the sac neck ratio based on ROC curve analysis with a cut off of 2.6 is of 49.1% and 70% respectively. This study concludes that patient who fall beyond the cut off sac neck ratio must be offered surgery in elective setting sooner to prevent further development of symptoms and complications.

Hence hernia sac neck ratio is a specific tool which can be used as a factor to determine a patient's risk of developing complications in umbilical hernia.

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