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The role of umbilical hernia sac neck ratio in predicting the development of symptoms and complications

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Abstract

Background: The morphology of an umbilical hernia is important in deciding the course of symptoms and complications as a hernia with a narrow neck and a large sac is more prone to complications. At present there are no fixed guidelines on when to operate on an umbilical hernia. This study considers the morphological characteristics of the hernia using the hernia sac-neck ratio and an ultrasound as a non invasive tool in predicting the development of symptoms and complications.

Methods: This study is a DESCRIPTIVE/OBSERVATIONAL study conducted at JSS HOSPITAL MYSORE from November 2017 to December 2019. For All cases presenting to JSS hospital with an umbilical hernia an ultrasound abdomen was performed to note the size of the neck of the hernia. The diameter of the hernia was measured clinically and the required ratio calculated.

Results: 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 un complicated 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.

Conclusion: This study concludes 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.

Keywords: Sac neck ratio, sack size, neck size, complicated, uncomplicated

Introduction

A ventral hernia is defined by the protrusion of a viscus through the anterior abdominal wall fascia. "According to the European hernia society, any hernia arising in the midline 3cm above to 3cm below the umbilicus is called as an umbilical hernia ^[1]" Based on the location of these defects over the anterior abdominal wall they can be classified Into spontaneous or acquired variety. Umbilical hernias in adults are largely acquired with only 10 percent of the adults giving history of umbilical hernia at birth, which means 90 percent of congenital umbilical hernias close spontaneously.

The Incidence of Umbilical hernia in the adult population is 2% being much more common in obese individuals, women with multiple pregnancies, patients with liver cirrhosis and ascites ^[2]. Up to 20% of cirrhotic patients with ascites develop umbilical hernia. The incidence of umbilical hernia has a female preponderance with a ratio of 3:1. Anatomically, the umbilical hernias occur either through a potential weakness present at the point of exit site of involuted umbilical vessels, the most important being the the umbilical vein or through the weakened umbilical fascia also known as Richet's fascia. It has been observed that patients presenting with Umbilical hernia lack the umbilical fascia, and the round hepatic ligament is not attached to the inferior border of the umbilical ring.

Paediatric umbilical hernias have an incidence of 15 to 23%, being more common in the African American and Hispanic infants. Of the hernias that occur prior to 6 months of age most of them resolve by the first year of life. Larger ones take time but will be closed by 5 to 6 years of age. In adults Umbilical hernias may contain omentum, preperitoneal fat, small bowel or a combination of the above mentioned. The transverse colon is very rarely found to be a content of the hernial sac. In umbilical hernias compared to inguinal hernias the neck of the hernial sac is narrow compared with the size of the hernial sac, therefore incarceration and strangulation are common. In India the most common presenting complaint in patients with an umbilical hernia is pain which occurs long after the hernial bulge is noticed.

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Pain is either due to venous congestion due to incarceration of the omentum at the hernial neck or due to intermittent bowel obstruction. Patients can also present as an emergency due to strangulation. Surgery in such situations only increases the morbidity and mortality.

At present there are no fixed guidelines on when to operate on an umbilical hernia, which makes the patient and surgeon wait until the former presents with increased severity of the symptoms or with life threatening complications. There are lots of studies comparing the various techniques of umbilical hernia repair and the outcomes with respect to operating time, intra and post-operative complications and the recurrence rates. This study aims using the hernia sac neck ratio (SNR) as a parameter that could give the surgeon an option to offer surgery to all patients falling beyond the cut off ratio to avoid the situation of performing surgery in an emergency [3].

Materials and Methods

This study is a Descriptive/Observational study conducted at JSS Hospital Mysore between november 2017 to December 2019 in the department of General Surgery. (IEC Clearance Details To Be Mentioned)

Taking sensitivity as 50% and precesion 15% with a 5% alpha error the sample size is taken as 50 with convenient sampling.

The inclusion criteria for cases in the study is as follows

-All patients presenting to JSS hospital with an umbilical hernia.

The exclusion criteria being

- Patient’s with congenital umbilical hernia.
- Patients aged less than 5 years.

For All cases presenting to JSS hospital under the inclusion criteria, a detailed history and clinical examination was carried out. Those patients who presented with pain, irreducibility, obstruction and strangulation were included in the complicated group and the rest with just a painless bulge into the uncomplicated group. The size of the hernial sac was measured clinically using a divider and an ultrasound was performed to note the size of the neck of the hernia.

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 of the hernia neck ratio in predicting the development of symptoms and complications.

Statistical Analysis

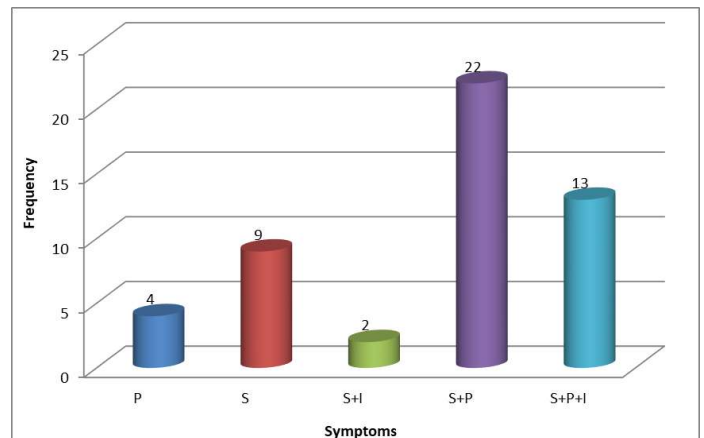
- Data analysis was done using mean, median, mode standard deviation, Inter quartile range and proportions.
- Software used SPSS22
- Inferential statistics will be done using area under curve with 95% Confidence interval and Receiver Operator Characteristic curve.
- Sensitivity, specificity, Negative predicitive value and

positive predictive value will be measured with 95% confidence interval.

- Mann whitney U test and independent t test used.
- A p value of <0.005 was considered statistically significant.

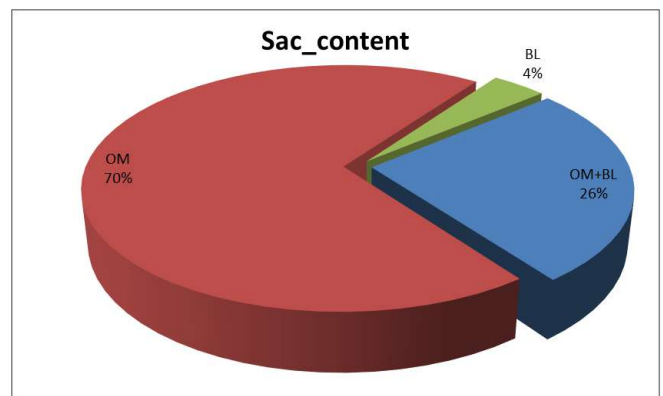
Results

The sex distribution in our study was as follows with 23(46%) females and 27(54% being males). Swelling associated with pain was the most common presenting feature of patients with umbilical hernia in this study at 44%.32% out of the patients in the study were incidentally detected with asymptomatic cholelithiasis. In the study, the mean hernia neck size in the complicated group was 2.02 cm with a P value of 0.091 which is much smaller than the neck size in the un complicated group which is 2.95 cm. The Mean hernia sac size the uncomplicated group having a mean sac size of 5.54 and the complicated group having a sac size of 5.45 with a P value of 0.911.The hernia sac neck ratio (SNR) 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 which is statistically significant with a P value of <0.02.A cut off hernia sac neck ratio of 2.2 was associated with a 90% sensitivity and 70% specificity.



P-pain
S-swelling
I-irreducibility

Graph 1: Symptoms

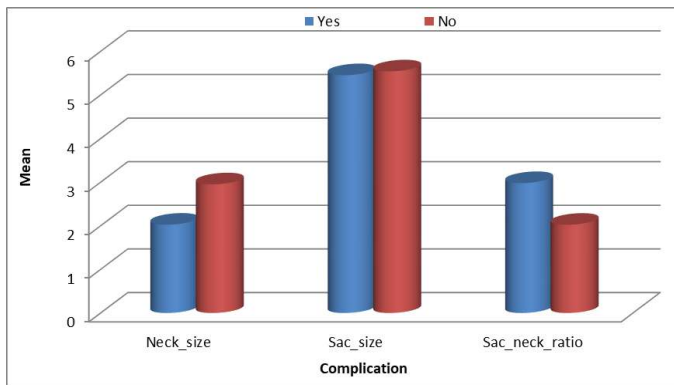


OM-omentum
BL-bowel

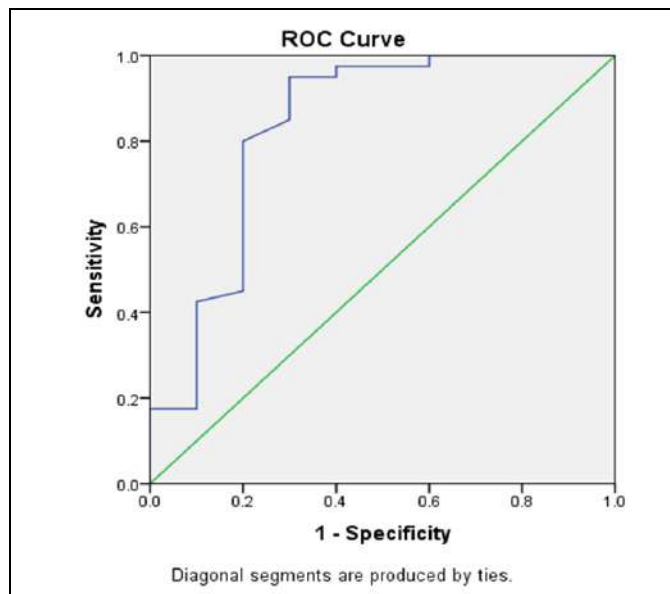
Graph 2: Sac Content

Table 1-Neck, sac and sac neck ratio with independent t test.

	Complication	N	Mean	Std. Deviation	Std. Error Mean	
Neck size	Yes	40	2.0250	1.41869	.22432	
	No	10	2.9500	1.87572	.59316	
Sac size	Yes	40	5.4525	2.18397	.34532	
	No	10	5.5400	2.26627	.71666	
Sac neck ratio	Yes	40	2.9790	.84675	.13388	
	No	10	2.0230	.77066	.24370	
Independent Samples Test						
		t-test for Equality of Means				
		t	df	P VALUE	Mean Difference	Std. Error Difference
Neck size		-1.727	48	.091	-.92500	.53561
Sac size		-.113	48	.911	-.08750	.77769
Sac neck ratio		3.246	48	.002	.95600	.29452



Graph 3: (Sac, neck, SNR with complications)



Graph 4: ROC curve

Discussion

Umbilical hernia as already discussed is the second most common ventral wall hernia with a tendency for patients to present to the surgeon with complications which appear long after development of symptoms such as a painless hernial bulge. At present there not many studies which take into account the morphological characteristics of the hernia in predicting the course and tendency to develop complications. In this study we have taken the hernia sac neck ratio (SNR) as a single factor in predicting the development of complications. A total of 50 patients were studied out of which 40 patients had some form of complication and 10 with uncomplicated hernia. The mean sac size in the uncomplicated group was 5.54cm and

in the complicated group was 5.45 cm. The neck size in the complicated group was 2.02 and the uncomplicated group was 2.95 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 neck ratio in this study was found to be more 2.97cm in the complicated group and much lesser in the uncomplicated group at 2.02cm with a P value of <0.02 which is statistically significant.

Fueter *et al.* In Retrospective review of adult patients with elective and emergent umbilical hernia repair operated from January 2004 to December 2013 published in the world journal of surgery, The size of the hernia and the size of the neck were measured. The Hernia-Neck-Ratio (HNR) was then calculated as novel risk indicator. Out of 106 patients that underwent umbilical hernia repair 70 were for uncomplicated and 36 for “uncomplicated hernia. 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^[3].

There is conflicting data on the relationship between hernia defect size and complication rates. Two studies suggest that larger defects are more prone to acute complication. A Nigerian 47-patient case series by Ameh *et al.* documented all complications occurred in hernias with defect greater than 1.5 cm 23. In our study the mean neck size for the complicated group was 2.02 cm and the neck size in the uncomplicated group was 2.95cm which means that the uncomplicated group had a larger neck size than the complicated group^[4].

Similarly, a Nigerian cohort study of 52 children by Chirdan *et al.* found a median hernia defect size of 2 cm in acute incarceration and 2.5 cm in recurrent incarceration. In contrast, an American study of 489 children by Zendejas *et al.* found the mean defect size for a hernia requiring emergent repair was 1.0 compared to 1.5 cm in hernias repaired electively (p value=0.008)^[5].

Lassaletta *et al.* determined in his study of 590 children that defects of 0.5 cm to 1.5 cm were the most prone to complication with an incidence of 7.4%. The complication incidence for defects less than 0.5 cm was 4.3% and defects greater than 1.5 cm was 3.7% in this study. Similarly, Vrsansky *et al.* from France documented 75% of incarceration or strangulation occurred in defects less than 1.5 cm. In this study how ever children were not included in the study and so the results of the above mentioned study cannot be commented upon. Komlatse *et*

al. from the Togo found no incarcerations in the hernias with greater than 3 cm defect^[6, 7].

In majority of the studies the complication rates were higher with a smaller neck size and a larger hernia neck ratio. This only further goes to say that an umbilical hernia with large sac and a small neck are more prone to complications. Using ultrasonography as a non invasive and an economic investigation, Umbilical hernia being an easy diagnosed and the sac neck ratio obtained. Surgery being straight forward, early surgery before the development of complications reduces patient morbidity and mortality.

As patient knowledge on the topic of umbilical hernia is limited, the patients should be counselled in detail about the condition, the course of the disease, its tendency to present with complications and the advantage of elective surgery over emergency surgery which reduces patient morbidity.

Conclusion

Umbilical hernia though has female preponderance with a ratio of 3:1, this study had 54% males and 46% females. The most common presenting feature in patients with umbilical hernia is swelling associated with pain (44%). The mean sac neck ratio was larger in the complicated group. The sensitivity and specificity of the sac neck ratio based on ROC curve analysis was 90 percent and 70 percent respectively with a cut of >2.2. Thus this study concludes that the umbilical hernia sac neck ratio is a sensitive tool for predicting the development of symptoms and complications and all patients who fall beyond the cut off Sac neck ratio (SNR) must be offered surgery to avoid the same.

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