

UC San Diego

Independent Study Projects

Title

Diastatis Recti as a predictor for umbilical hernias

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Author

Shah, Suzanne Syeda

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ABSTRACT

Acquired umbilical hernia (UH) is a common surgical condition and is usually associated with conditions that increase intra-abdominal pressure such as pregnancy, ascites and obesity. Despite the high frequency of their occurrence, umbilical hernias have received little attention in the literature relative to other abdominal wall hernias, and to our knowledge, there are no studies that investigate the role of defects in the abdominal wall in the development of acquired umbilical hernias. We hypothesize that diastasis of the rectus abdominis muscles is a major predictor for acquired umbilical hernias. Method: WE measured the inter-recti distance (IRD) on abdominal computed tomography (CT) of 100 randomly selected patients with UH diagnosis. Did a multi-linear regression analysis on R program. Results: 1. Increasing BMI is significantly associated with increasing inter-recti distance after diagnosis, the beta-coefficient is 1.26 and p-value is 0.0003. 2. Both BMI and age are associated with increasing IRD after diagnosis, BMI beta = 1.067, with p-value 0.000134 and age beta = 0.2556 and p-value 0.024670. Conclusion: In the preliminary results of the analysis of those diagnosed with UH, we can see the BMI correlates with inter-recti distance after diagnosis and along with BMI and age being associated with increasing inter-recti distance. The next step of the project will be the comparison with the control to assess if increasing IRD is the cause of UH.

INTRODUCTION

Acquired umbilical hernia (UH) is a common surgical condition and elective repair is recommended for the majority of asymptomatic and symptomatic umbilical hernias. This is especially the case as incarcerated umbilical hernias account for 13% of all incarcerated adult hernias and roughly 20% of those repaired also require bowel resection (Bisgard et al. Hernia 2011). Known risk factors for developing umbilical hernias include advanced age, prior abdominal surgery, and conditions that increase intra-abdominal pressure, such as obesity, ascites and pregnancy. Despite the high frequency of their occurrence, umbilical hernias have received little attention in the literature relative to other abdominal wall hernias, and to our knowledge, there are no studies that investigate the role of defects in the abdominal wall in the development of acquired umbilical hernias.

The umbilical ring presents a potential weakness in the abdominal wall, which serves to support and protect the abdominal and retroperitoneal structures. Anteriorly, the abdominal wall is comprised of the paired rectus abdominis muscles, with vertically oriented fibers encased in an aponeurotic sheath fused in the midline at the linea alba ((*Schwartz's Principles of Surgery*, 9ed). Diastasis recti is a clinically evident separation of the rectus abdominis muscle pillars as a result of thinning and stretching of the linea alba. Since herniation usually occurs at sites of small fascial defects, we hypothesize that diastasis of the rectus abdominis muscles is a major predictor for acquired umbilical hernias.

In this multi-step study we will initially analyze data collected of the umbilical hernia cases. We will measure inter-recti distance (IRD) in computed tomography

(CT) studies obtained in patients prior to and after the clinical diagnosis of umbilical hernia (cases) on possible correlations of IRD to variable factors such as BMI, age, and gender. The next step will be the retrospective case-control study, where we will measure IRD in age- and BMI-matched patients who were not diagnosed with umbilical hernias (controls) but for whom abdominal CT examinations were obtained for other medical conditions. This paper will discuss the preliminary data collected of patients with only umbilical hernias and the analysis from measurements collected.

Despite advancements in surgical repair of umbilical hernias, they persist as an important surgical problem in adults. A better understanding of the natural history of this common clinical condition would ultimately lead to its better management and treatment.

METHOD

Step 1: we generated a search in the CPRS system in San Diego VA for the diagnosis of Umbilical Hernia ICD-9 code 553.1 and ICD-10 code K42.0 from 1990-2016.

Step 2: Then we did a chart review from the list for: age, gender, date of diagnosis, date of abdominal CT scan before the date of diagnosis, date of abdominal CT scan after the diagnosis, BMI on the date of the scan.

Step 3: Using the IMPAX imaging software, the abdominal CT scans were pulled up to measure the inter-recti distance. We viewed the images on a split screen with the cross-sectional and lateral view. From the lateral view, the mid-point from the beginning of the xyphoid process to the umbilicus was matched with the cross-sectional view to measure the inter-recti distance.

Step 4: Random selection of 100 subjects were generated using the 2016 Microsoft Excel program. A multi-variant regression linear model analysis was done through R programming (R Core Team (2016), with age, gender, and measurement of inter-recti distance before and after diagnosis.

Exclusion Criteria: Patients with prior midline abdominal surgeries or ascites. Patients that don't have abdominal CT imaging.

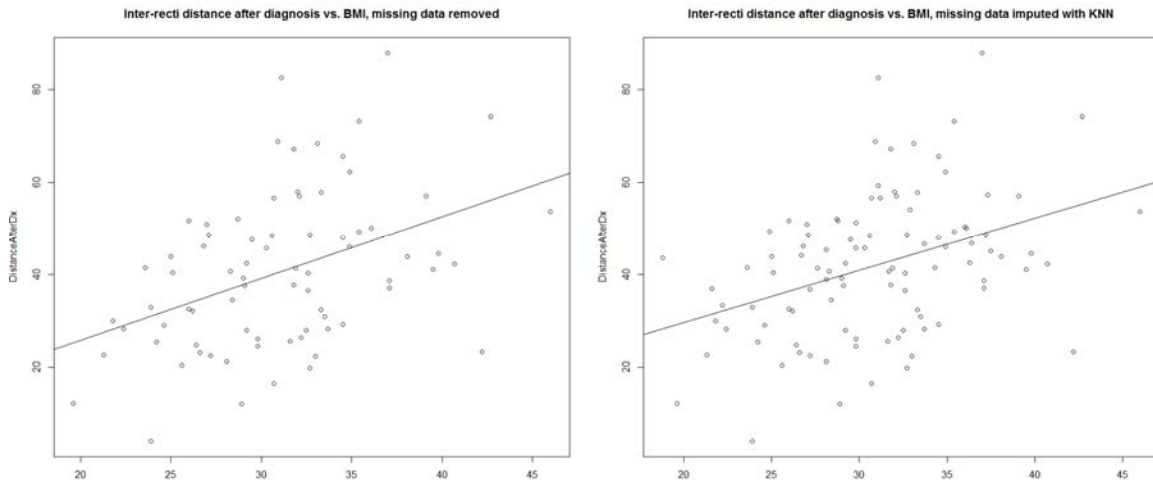
RESULTS

The search generated 493 subjects with the diagnosis of UH from dates 2009-2016. Out of the 100 randomly selected subjects, 5 were excluded due to poor visualization of the lateral views on CT imaging. Table 1 displays the demographic data of the subjects. The multi-variant regression linear analysis showed increasing BMI is significantly associated with increasing inter-recti distance after diagnosis, $\beta = 1.26$, $p = 0.00042$. Also, both BMI and age are associated with increasing inter-recti distance after diagnosis. The β for BMI is smaller ($\beta = 1.0674$), with p -value 0.000134, and age also being significant, with $\beta = 0.2556$ and $p = 0.024670$. Figures 1 and 2 graphical display the analysis.

Table 1: Demographic Data

N= 100		
Age		
Average	57.78	
Max	82	
Min	28	
Gender		
Male	92	
Female	8	
BMI		
Average	30.8715	
Max	46	
Min	18.75	
IRD before Diagnosis (mm)		Total = 29
Average	11.803	
Max	72.5	
Min	18.1	
IRD after Diagnosis (mm)		Total= 76
Average	30.65	
Max	87.9	
Min	4	

Figure 1 & 2



DISCUSSION

There has been a trend in increasing emergent umbilical hernia repair from 2001 to 2010 (Beadles et. el, *JAMA Surg* 2015). Yet umbilical hernias have received little attention in the literature relative to other abdominal wall hernias. Since from literature review there are no studies that investigate the role of defects in the abdominal wall in the development of acquired umbilical hernias, we hypothesized that diastasis recti is the cause of umbilical hernias. We used computed topographic imaging because it has been shown to provide an accurate and reproducible means of measuring the IRD (*Schwartz's Principles of Surgery*, 9ed). In this paper we randomly selected 100 subjects to see if there are any correlations of inter-recti distance with BMI, gender, age in patients with UH. The multi-variant analysis showed that there is statistically significant association of BMI with inter-recti distance after diagnosis of umbilical hernia with $p = 0.00042$. Furthermore, both age and BMI were significantly associated with increasing IRD after diagnosis, p -value 0.000134 BMI, $p = 0.024670$ age.

This preliminary result doesn't answer if diastasis recti does or does not cause umbilical hernia. That is the future of the study where we analyze data with BMI and age matched control of subjects that don't have a diagnosis of umbilical hernia. The results do show with those with umbilical hernias, there is a relationship of increase BMI and age to increasing inter-recti distance. Of course this may be already assumed that increasing body fat would impact abdominal girth and abdominal muscles. However, demonstrating the statistical significance of this correlation is the first part in demonstrating that diastasis recti maybe the cause of umbilical hernias.

CONCLUSION

Despite advancements in surgical repair of umbilical hernias, they persist as an important surgical problem in adults. The limitations of this study included that small number of subjects, the predominance of male subjects due to our chart

review consisting of the VA population, and no control. The future of this study is to obtain data on age- and BMI-matched patients who were not diagnosed with umbilical hernias (controls) but for whom abdominal CT examinations were obtained for other medical conditions and match it with our data.

A better understanding of the natural history of this common clinical condition would ultimately lead to its better management and treatment.

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