Case Report

Ultrasonography: A Useful Diagnostic Adjuvant in Equivocal Inguinal Hernia on History

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Abstract

Background
In children with inguinal hernia decision regarding surgery is made on clinical examination. In a subset of patients the clinical examination of groin is normal, rendering decision making difficult. An ultrasonic study of the groin can be helpful in such patients.

Objective
The objective of this study was to evaluate the role of ultrasonography in these patients by combining the two ultrasonicographic (US) parameters to increase the diagnostic accuracy thereby prevent unnecessary inguinal exploration.

Methods
This was a prospective study of patients having inguinal hernia on history treated from January 2012 to December 2014. 140 patients (146 groins) were included in the study. All the patients underwent US examination by using two US parameters, the width of the internal ring and length of fluid column from deep ring to superficial ring. Width of the internal ring more than 4mm and length of fluid column more than 1.5cm was taken as positive. Patients with positive US findings were explored and US findings were compared with surgical results.

Results
Out of 140 patients (146 groins), US was normal in 45 groins. 90 (63.6%) groins had positive width and length and were confirmed surgically. 11 (10.9%) groins had positive width and negative length in which 9 groins were confirmed surgically and in 2 groins inguinal exploration was negative. The accuracy of US in our study was 98%.

Conclusion
In patients with inguinal hernia on history with normal clinical examination, accurate diagnosis of hernia can be made by preoperative ultrasonography by combining the two US parameters, so that unnecessary inguinal exploration and associated morbidity can be prevented.

Keywords: Hernia on history; Ultrasonography; Diagnosis; Children.

Introduction
Inguinal hernia is one of the most common clinical entities encountered by pediatric surgeons in clinical practice. After testicular descent the processus vaginalis obliterates with only the distal part persisting as the tunica vaginalis. In 80-100% of infants, processus vaginalis communicates with the peritoneal cavity at birth and most of this close within first 6 months of life. Failure or incomplete obliteration predisposes to congenital inguinal hernia and hydrocele. Incidence of patent processus vaginalis (PPV) decreases to 40% by 2 years of age. Obliteration of PPV is unusual after the age of 2 years. About half of these patients develop clinically apparent inguinal hernia with reported incidence of 0.8% to 4.4% and male to female ratio “between” 3:1 to 10:1 [1].

The diagnosis of inguinal hernia is based on history and clinical examination. Treatment is both straightforward and gratifying. However, peculiar subsets of patients have history suggestive of inguinal hernia although clinical examination is apparently normal. Although, some subtle signs like the “silk glove sign” and “plastic baggy sign” are described to aid in the diagnosis in these patients, they are difficult to illicit and interpret especially for a beginner. We used to operate these patients on the basis of history alone and the occasional demonstration of the afore-mentioned signs. This approach led to an unacceptably high negative inguinal exploration rate of around 7% in our center. We expect similar kind of results at other centers, however it remained underreported.

Herniography, ultrasonography (US) and laparoscopy are used to detect a patent processus vaginalis (PPV) or hernia on the contralateral side when a bilateral hernia is suspected. US is a safe, noninvasive and accurate method for evaluating the presence of PPV or hernia [2, 3, 4, 5, 6]. Taking a clue from these reports, we evaluated the role of preoperative ultrasound in patients with...
hernia on history. In an effort to improve the accuracy of diagnosis, two parameters were combined. Primary aim was to determine the accuracy of ultrasound in detection of PPV, thereby aiding in preventing the unnecessary inguinal exploration with its attendant morbidity.

**Material and Methods**

This was a prospective study of patients having inguinal hernia on history and a normal clinical examination who were treated in our department from 1st January 2012 to 30th December 2014. Children with more than 2 years of age were included in the study, as closure of PPV occurs up the age of 2 years and it is unusual to close beyond the 2 years of age. Patients with subtle signs like the “silk glove sign” or the “plastic baggy sign” were also included in the study. The US of the groin was done by a single sonologist using 7.5 Mhz linear transducer. Width of the internal inguinal ring, inflow of peritoneal fluid or other contents in the canal both at rest and straining/ crying was seen. Length of potentially patent processus vaginalis was seen by measuring the length of fluid column from deep ring to superficial ring.

Width of the internal ring of more than 4mm was taken as positive and length of potentially patent processus more than 1.5 cm was taken as positive. Hernia was diagnosed when any organ was seen in canal or width of internal ring more than 7mm was seen. Patients with either or both the above mentioned positive findings were taken up for surgery. Standard inguinal exploration was performed and findings were noted in each case. The US findings were compared with operative findings.

**Results**

One hundred forty patients were included in this study. Unilateral history of inguinal hernia on history was present in 134 patients and bilateral history of inguinal hernia in 6 patients (146 groins). US examination was considered positive as per the study criteria in 101 groins. Both parameters were positive in 90 groins (89.1%) (Figure 1 and figure 2). Among these patients, mean diameter of the internal ring was 5.3 mm and mean length of PPV was 2.1 cm. In 11 (10.9%) groins width was positive but length was negative. Among 101 groins, 15 (11%) groins have silk glove sign/plastic baggy sign positive on examination. In 45 groins, US were negative and these patients are on follow up and none of these patients had developed obvious inguinal hernia.

101 groins with positive US findings were explored and US findings were compared with operative findings. In 99 (98%) groins, the operative findings coincided with the US findings (positive inguinal exploration) and in 2(2%) groins, US positive patients inguinal exploration was negative (Table 1). 15 groins with positive silk glove sign on examination, all had hernia on exploration. In our study, the accuracy of US to detect the PPV or hernia was 98% with a false positive rate of 2%. There were no significant differences between the ring diameters, age, sex and side.

**Discussion**

Herniotomy is the most frequently performed surgical procedures in children [7]. In children with inguinal hernia, herniotomy is simple and straightforward procedure. However patients with history of occasional swelling in the groin, the clinical examination is normal. Some signs like silk glove sign or plastic baggy sign may be present on clinical examination, but these are difficult to demonstrate particularly in patients with short history of inguinal hernia. In such cases history and clinical examination alone are not able to assist the surgeons to reach the diagnosis of inguinal hernia. In these patients it is difficult to decide which patient needs surgical exploration. Ethically and medico legally it is very important to have accurate diagnosis before exploration in such inconclusive cases. Preoperative diagnosis of PPV is important to avoid the unnecessary inguinal exploration. Various methods of investigations such as herniography, ultrasonography and laparoscopy are used to detect the PPV or hernia. Laparoscopy combined with the selective use of probing is effective to determine the presence of PPV if the length of PPV is more than 1.5 cm [8]. However the disadvantage of this method is that it is invasive and needs general anesthesia, with its associated neurocognitive and other morbidities. Ultrasonography is noninvasive method to diagnose PPV using a 7.5 MHz superficial linear transducer either
by detecting as a hydrocele owing to the inflow of fluid in to the processus vaginalis on straining or classified according to Toki et al [5].

Erez I et al has reported that the anatomy of inguinal canal is normal when preoperative ultrasonography of the groin shows width of internal ring 3.6 +/- 0.8 mm. A PPV was found when a width of 4.9 +/- 1.1 mm was detected. A full hernia was found when a width of 7.2 +/- 2.0 mm was detected [9]. Ultrasonography serves as a noninvasive and highly accurate diagnostic tool for detecting the PPV or hernia. Using 4 mm as the upper limit of the normal diameter of the deep inguinal ring, an occult inguinal hernia can be detected before surgery [10]. Other authors have also reported US as safe, uncomplicated, noninvasive and accurate method for evaluation and diagnosis of PPV or hernia before surgery using equal to or more than 4 mm diameter of internal ring as positive [2, 3, 4, 5, 6, 10]. In our study, we have used two US parameters to give more accurate diagnosis of PPV or hernia before surgical exploration. The US parameters used are diameter of internal ring and length of potentially patent processus using more than 4 mm diameter of ring and length more than 1.5 cm as positive. Chou TY et al have analyzed the value of preoperative ultrasound for the detection of PPV or hernia in children who are at risk of development of hernia when the clinical findings are equivocal or normal. They have reported 95% accuracy of US for evaluating the presence of PPV or hernia and can provide an objective measure in determining the advisability of exploratory inguinal surgery in such cases [2]. Hata S et al have reported 94.7% and Chen KC et al have reported 97.9% accuracy of US for detecting patent processus us or occult inguinal hernia before surgery [3, 10]. In our study the accuracy of US is slightly higher (98%) than reported by other author’s because we have combined the two US parameters to be very sure about the diagnosis before the surgical exploration.

**Conclusion**

In patients with inguinal hernia on history with no demonstrable hernia, ultrasonography of groin can be used to detect the PPV or hernia in such cases. Accuracy of the US can be increased by combining the two US parameters, the diameter of internal ring and length of potentially patent processus vaginalis. Thus patients with history of inguinal hernia and normal clinical examination, ultrasonography of the groin can help the surgeon to plan the appropriate treatment in such cases.

**References**


**Table-1:** Comparison of US parameters with operating findings.

<table>
<thead>
<tr>
<th>US finding</th>
<th>No of groins</th>
<th>Percentage (%)</th>
<th>Operative finding</th>
<th>Accuracy of US (%)</th>
<th>False positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive width and length</td>
<td>90</td>
<td>89.1</td>
<td>90</td>
<td>98</td>
<td>2</td>
</tr>
<tr>
<td>Positive width and negative length</td>
<td>11</td>
<td>10.9</td>
<td>9</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>101</td>
<td>100.0</td>
<td>99</td>
<td>2</td>
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