Original Article

Comparing Clinical Examination versus Ultrasound in Detecting the Presence of Contralateral Patent Processus Vaginalis in Patients with Inguinal Hernia/Hydrocele in a Developing Country

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Abstract

Background: Inguinal hernias are extremely common conditions in childhood and form a large part of the general paediatric surgical practice. While most hernias are unilateral, bilateral ones are usually recorded. In patients with bilateral hernias, the hernias on the contralateral side may not be clinically detectable at the time of the herniotomy. There has been the debate about the necessity and indications for exploring the apparently normal side during herniotomy. The aim of the study was to compare objectively the sensitivity of silk glove sign and ultrasound in detecting presence of a patent processus vaginalis (PPV). **Materials and Methods:** This is a prospective comparative study. A total of 79 patients with confirmed unilateral inguinal hernias were examined for the presence of patent contra-lateral by checking for a positive silk-glove sign. These patients subsequently had an ultrasound scan done on the same contralateral side by a different senior paediatric surgery resident trained in taking such scans with the supervision of a consultant radiologist (all blinded to the clinical findings). Patients who exhibited both positive clinical and ultrasound findings underwent herniotomies on the symptomatic side accompanied by contralateral exploration. Collated data were entered and analysed using the SPSS software version 27.0. $P < 0.05$ was considered statistically significant. **Results:** The hernias occurred more on the right − 52 (65.8%) and 25 (34.2%) on the left. A total of 53 (67.1%) had hernias, while 26 (32.9%) had hydroceles. The sensitivity, specificity and diagnostic accuracy of the silk glove sign were 100.0% respectively, for all 4 patients that were positive, while the ultrasound scan had a sensitivity of 98.7%, specificity of 100% and diagnostic accuracy of 98.7%. **Conclusion:** This study demonstrates that both the silk glove sign and ultrasound are equally effective in detecting the PPV in the contralateral groin of patients with unilateral inguinal hernia and hydrocele. The comparable sensitivities, specificities and diagnostic accuracies between the two methods suggest that either can be reliably used in clinical practice, depending on the availability of resources and the clinician's expertise.

Keywords: Hydrocele, Inguinal hernia, patent processus vaginalis, pediatric surgery, silk glove sign, ultrasound

Introduction

Inguinal hernias and hydroceles are extremely common conditions in infancy and childhood and form a large part of the general paediatric surgical practice. The reported incidence of inguinal hernia in children ranges from 0.8% to 4.4%,[1] which correlates fairly well with the patency rates of the processus vaginalis. Surgery for both hernia and hydrocele (herniotomy) is very common in paediatric surgical practice and accounts for more than 60% of the total paediatric surgical procedures.

While most hernias and hydroceles are unilateral, they occur bilaterally in about 5%–10% of cases, the hernia on the contralateral side may not clinically be detectable at the time of the initial herniotomy and thus continuing debate about the necessity and indications for both assessing and exploring the apparently normal side during herniotomy. In order to minimise

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the incidence of negative exploration of the contralateral side, methods have been used to support clinical examination, such as ultrasonography, herniography, diagnostic pneumoperitoneum and intraoperative laparoscopy.[2] By comparing the outcomes of a physical examination and ultrasound scan to determine the patency of the contralateral processus vaginalis, we can reduce the rate of negative explorations, avoid a second operation for parents and patients, avoid the risk of incarceration, reduce complications from a second surgery and reduce the cost implications of a second surgery. Furthermore, there has been a paucity of studies on this particular modalities in the low-income countries where it is most valuable as most hospitals are not as equipped when compared to their high income counterparts.

Materials and Methods

This study was carried out at the University of Abuja Teaching Hospital, Abuja, Nigeria.

The selection was successively done by recruiting new patients who satisfied the inclusion criteria (patients with inguinal hernias and hdyroceles that consented to take part in the study). The patients' biodata and history were obtained and a thorough physical examination was done by a senior paediatric surgery resident, followed by a contralateral groin ultrasound scan (by a senior paediatric surgery resident blinded to the clinical findings), clearly documenting the findings. Patients who had positive results from either the silk glove sign or the ultrasound had subsequent herniotomies with exploration of the contralateral groin to confirm the positivity. The study excluded patients with clinically evident bilateral inguinal hernia/hydroceles or recurrent hernias/hydroceles, those whose parents did not consent to participate, those with obvious predisposing factors (bladder exstrophy, ventriculoperitoneal shunts and raised intra-abdominal pressure) and those with features of incarceration, obstruction and strangulation. The study was conducted over 8 months.

The University of Abuja Teaching Hospital Research and ethics Committee granted ethical approval for the study (UATH/HREC/451). We counselled the patients' parents on the nature, purpose of the study and obtained their written informed consent.

Clinical assessment

A detailed clinical assessment of the patient was carried out with focus on the contralateral groin to demonstrate the 'Silk glove sign' in assessing for patency of the processus vaginalis. This was performed by laying a single finger over the spermatic cord at the level of the pubic tubercle; the finger was then lightly rubbed over the cord from side to side on the pubic tubercle. A positive silk glove sign indicated that the cord structures are thickened compared with the normal side. The examination imparted a sensation to the examiners fingers as if he or she were rubbing two pieces of silk together. An ultrasound scan followed blinding the result to the physical examination findings.

Ultrasound assessment

The patient was made to lie on an examination couch with their parents helping them supine (for kids 1 month and 4 years old). The field of view was exposed (inguinal region), ultrasound gel was sparingly spread on the area (contralateral groin) and a 5.0–7.5 mHz ultrasonic linear probe was moved back and forth to get the desired image. A patent processus vaginalis (PPV) was found when one or both of the following were present:

a. Detection of a herniated intra-abdominal viscus in the inguinal canal, accompanied by an increase and decrease in intra-abdominal pressure due to peristaltic activity within the canal
b. The internal ring exhibits a (hypoechoic) cyst-like structure.

Intraoperative assessment

Patients who demonstrated a positive silk glove sign and positive ultrasound findings underwent contralateral groin exploration. The procedure involves making an inguinal crease incision, deepening it to the level of the external oblique aponeurosis and identifying the external ring with the cord structures exiting it.[3,4] We carefully identified the anteromedially placed PPV, separated it from the cord structures (male), ligated highly and wound closed in layers.

Data collected were entered and analysed using the Statistical for the Social Sciences software version 21. (SPSS Inc. Chicago, IL, USA). The data were presented in frequency tables and diagnostic parameters such as sensitivity, specificity, positive predictive value and negative predictive value were used to compare the clinical and ultrasound findings to actual intraoperative findings. We analysed the presence of PPV using the Chi-square test. $P < 0.05$ was considered statistically significant.

Results

The study involved 79 patients, with an age range of 12–148 months. The male patients were 74 (93.7%), whereas the female patients were 5 (6.3%), with a male-to-female ratio of 14.8:1. A total of 52 (65.8%) subjects presented with right-sided swelling, whereas left-sided presentation was in 27 (34.2%). Fifty-three (67.1%) presented with hernia while 26 (32.9%) presented with hydrocele, as shown in Table 1.

Silk glove sign on the contralateral groin was positive in 4 (5.1%) patients, the remaining 75 (94.9%) were negative. A total of 3 (3.8%) patients on ultrasound on ultrasound while 76 (96.2%) were negative. All four positive patient positive silk glove presented with hernia with 3 (3.8%) right sided and 1 (1.2%) left sided. All patients with positive ultrasound findings also presented with hernia, as shown in Figure 1.

A total of 4 (5.1%) patients who had positive silk glove sign and positive ultrasound scanning of the contralateral side underwent a contralateral groin exploration. This exploration revealed positivity in 4 (5.1%) of these patients, thereby classifying 1 of the negative ultrasound findings as a false

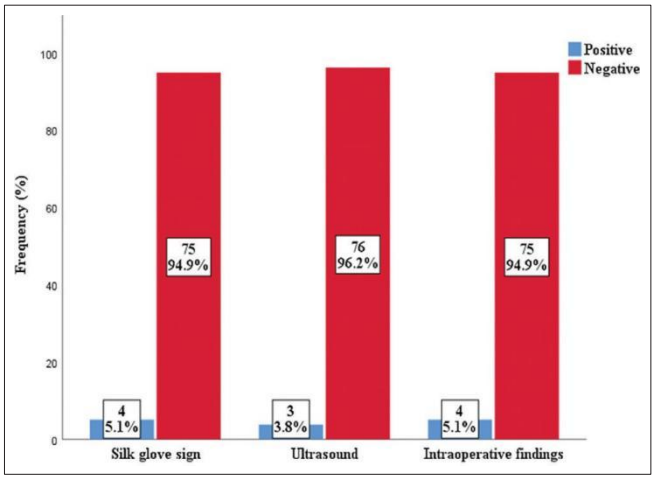


Figure 1: Assessment of contralateral patent processus vaginalis using different methods

negative and all the positive silk glove findings as true positives. Table 2 illustrates this.

The sensitivity of carrying out a silk glove sign was 100% while ultrasound scan was 98.68% Specificity and positive predictive value for both (silk glove sign and ultrasound) was 100%.

Negative predictive value of ultrasound was 75% with *P* value of 0.01(<0.05), while for silk glove sign was 100%. The diagnostic accuracy for both silk glove sign and ultrasound was 100% and 98.73%, respectively.

No significant association between contralateral PPV and selected characteristics assessed ($P < 0.05$). The association between contralateral patent processus vaginalis and selected demographic and clinical characteristics is shown in Table 3.

Discussion

Inguinal hernias and hydroceles account for one of the most commonly seen cases in paediatric surgical clinics worldwide.[5,6] It is important to state that hernias and hydroceles can occur subclinically (on the contralateral side) despite applying certain modalities like increasing the intra-abdominal pressure and watching out for a bulge. It is also worthy of note as found out by Ikeda *et al*. that the risk of metachronous manifestation of contralateral hernia is high in patients with left-side hernia, those with a family history and the incidence of contralateral hernia is at most 10% in these patients.[6,7] One cannot overstate the importance of the silk glove sign, which aids in detecting the presence of PPV by feeling or palpating for a thickened cord.[8] Ultrasound scan of the contralateral groin can also help in detecting the presence of this processus vaginalis either by detection of an intra-abdominal viscus (on increment of intra-abdominal pressure) or presence of a cyst like structure at the internal ring.[9] The advent of laparoscopic techniques currently discourages the routine exploration of the contralateral groin due to its high morbidity rates, where the contralateral ring can be viewed easily while fixing the ipsilateral side. In the low-income economies, this tool are not readily available, and where it is, the cost implications are significant, leading to the adoption of other modalities such as the silk glove sign and ultrasound. The aim of this study was to objectively compare the sensitivity of these two modalities and establish a protocol that could aid in the management of patients presenting to this centre and other paediatric surgery practicing centers, given the paucity of studies that compare both modalities as confirmed by Nataraja and Mahomed[10] where only relationship of children with inguinal bulge and silk glove sign was compared.

Table 1: Socio-demographic and clinical characteristics

Variable	Frequency (*n*=79), *n* (%)
Sex	
Male	74 (93.7)
Female	5 (6.3)
Side of the body	
Right	52 (65.8)
Left	27 (34.2)
Diagnosis	
Hernia	53 (67.1)
Hydrocele	26 (32.9)

Table 2: Diagnostic accuracy of clinical assessment and ultrasound in contralateral patent processus vaginalis

Modality	Silk glove sign	USS finding
True positive, *n* (%)	4 (5.1)	3 (3.8)
True negative, *n* (%)	75 (94.9)	75 (75.0)
False positive, *n* (%)	0	0
False negative, *n* (%)	0	1 (1.3)
Sensitivity (%)	100	98.7
Specificity (%)	100	100
Positive predictive value (%)	100	100
Negative predictive value (%)	100	75
Diagnostic accuracy (%)	100	98.7

Table 3: Association between contralateral patent processus vaginalis and selected characteristics

Variables	Positive (*n*=4), *n* (%)	Negative (*n*=75), *n* (%)	Chi-square test	*P*
Age groups (months)				
≤12	0	24 (100.0)	5.356	0.253
13–36	3 (12.0)	22 (88.0)		
37–60	0	15 (100.0)		
61–144	1 (10.0)	9 (90.0)		
145–148	0	5 (100.0)		
Gender				
Male	3 (4.1)	71 (95.9)	2.477	0.115
Female	1 (20.0)	4 (80.0)		
Side				
Right	3 (5.8)	49 (94.2)	0.158	0.691
Left	1 (3.7)	26 (96.3)		

From this study, the mean age of patients with unilateral inguinal hernia/hydrocele was 37.49 months, the toddlers accounting for 44 (55%) of the patients studied. It is important to note that 3 of the 4 patients with positive silk glove sign, ultrasound, and intraoperative findings were toddlers (75%). However, this (contralateral PPV) did not happen more than once in any the age group ($P > 0.05$).

All patients exhibiting contralateral positive silk glove sign had hernias, three of which were right sided and one left sided. These patients also showed positive ultrasound results, with the exception of one, which was initially negative but later confirmed as positive upon exploration. We found the silk glove sign on the contralateral side to be accurate in all four patients we explored, with a sensitivity of 100%, specificity of 100% and diagnostic accuracy of 100%, closely resembling to the study by Luo *et al.*,[11] which reported a sensitivity of 93.1% and specificity of 97.3%. Ultrasound scan yielded accurate results in three out of the same four explored cases with one false-negative result. This accuracy resulted in a sensitivity of 98.68%, specificity of 100%, negative predictive value of 75% and diagnostic accuracy of 98.73%. This correlates with the ultrasound study by Hashish *et al.*,[12] which showed sensitivity − 87.1%, specificity − 98.6% and diagnostic accuracy of 96.5%, however the study carried out by Lawrenz *et al.*[9] on ultrasound differs with this, with sensitivity of 78%, specificity − 20% and diagnostic accuracy of 65%. Puntharee *et al*.[13] conducted a study comparing the silk glove sign and ultrasonography revealing that ultrasound had 95.8% sensitivity, specificity of 100% and diagnostic accuracy of 96%. In contrast, the silk glove sign demonstrated a sensitivity of 89.6%, a specificity of 50% and a diagnostic accuracy of 88%,[13] suggesting that ultrasound is a superior modality for detecting contralateral PPV. Following up on the patients for a minimum of 6 months from the initial evaluation, the findings showed similar sensitivities and specificities. The silk glove sign showed a sensitivity of 98.7%, specificity of 100%, while ultrasound showed sensitivity of 97.3% and specificity of 100% and diagnostic accuracies of 100% and 97.4%, respectively.

However, this study shows that both ultrasound scans and silk glove signs can be used to make diagnoses. This is because they are both sensitive and specific and neither is statistically better than the other. However, the ultrasound scan had a higher chance of giving a false negative ($P < 0.01$). The study deduced 5.1% incidence rate of contralateral PPV in children, compared to 15–20% rate in a larger population study by Schier *et al.*[14] and some other related studies.[15]

The study's limitations include the use of a two-dimensional ultrasound machine; a three dimensional would have been more accurate.

Conclusion

The study concluded that the silk glove sign demonstration and ultrasound scan had similar sensitivities, specificities and diagnostic accuracy in detecting the patency of PPV in the contralateral groin in patients with unilateral inguinal hernia and hydrocele, with none superior to the other.

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Conflicts of interest

There are no conflicts of interest.

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