

**INFLUENCE OF ULTRASOUND ON SURGICAL DECISION MAKING AND
PATIENTS' OUTCOMES IN SUSPECTED ACUTE APPENDICITIS: LOCAL
SURVEY OF SURGEONS' OPINIONS IN ADEN, YEMEN**

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ABSTRACT

Even in experienced hands surgeons, the diagnosis of acute appendicitis may still be challenging. The results of ultrasonography were used as an aid for surgeons in making an operative decision. For that reason, we aimed to investigate how ultrasound might affect an individual surgeon's decisions and outcomes in patients with acute appendicitis in Aden city hospitals – Yemen. This study was a cross-sectional survey among surgeons and residents. The survey consisted of 10 multiple choice questions with closed-response. In total, 100 surgeons were participated. Within their practice, 38% of surgeons were chose moderately high grade for ultrasound use, 38% chose moderate grade for decision not to operate and 49% chose moderate grade for sonographic findings matching with postoperative diagnosis in certain clinical diagnosis cases. Whereas 45% surgeons were chose moderate grade for elimination confusion in diagnosis and decision to operate and 54% chose moderate grade for sonographic findings matching with postoperative diagnosis in uncertain clinical diagnosis cases. From the standpoint of a surgeons, 44% chose moderately high grade for operator dependent, 44% chose moderate grade for reduced negative appendectomies, 40% and 35% chose moderately high grade for reduced complications and for shortened length hospital stay respectively and 55% chose moderately high grade for detect other pathology. In the absence of clear clinical guidelines, surgeons vary widely in their decision making regarding surgery, especially in cases of discretionary surgery. However, ultrasound has been significantly affect in their surgical decision making and improves patient outcomes. Undoubtedly, those results call for changes in surgical management decisions.

Keywords: Acute appendicitis, Ultrasonography, Surgical decision making, patient outcomes.

INTRODUCTION

Appendicitis is the most common abdominal emergency. The diagnosis of appendicitis can be challenging even in the most experienced hands, and is predominantly a clinical one (Chana, & Ahmad,2005; Özdemir, Özdemir, Sunamak, & Cambaztepe,2018; Tauro et. al., 2009; AlFraih, Postuma, & Keijzer, 2014). Wrong diagnosis of appendicitis led to a high rate 8 – 30% of unnecessary laparotomies (Tauro et. al., 2009; Alessandro R, Battista, 2017; Khorasani, 2003. Ultrasound examinations for acute appendicitis became increasingly popular, several series from the literature report excellent results. Different authors have shown that sonography adds up to 40% more information to these clinical examinations (Özdemir, et. al,2018; Alessandro R, Battista, 2017; Elahifar, Taheri & Bighamian, 2012; Scammell, 2011) and leads to a change in management in 20% of cases (Chana, & Ahmad,2005; Taheri & Bighamian, 2012; Vidmar et. al,2006). Thus, sonography is considered as first-line imaging modality in emergency departments for diagnosis acute appendicitis (Özdemir, et. al, 2018; Taheri & Bighamian, 2012; Sandellet et. al, 2015; Mostbeck et. al, 2016). Nevertheless, ultrasonography role in the decision-making process and outcomes of patients with suspected acute appendicitis varies between different institutions, surgeons, hospitals and countries. Therefore, we aimed to investigate how ultrasound might affect an individual surgeon's decisions and outcomes in patients with acute appendicitis in Aden city hospitals – Yemen.

METHODS

The study was a cross-sectional survey among surgeons and residents in Aden city – Yemen, which took place in June, 2018. A pre-designed, self-administered, 10-item survey was prepared in English and Arabic languages and sent to 100 surgeons hand by hand. At the beginning of the questionnaire, the purpose of the study was explained. Participation was voluntary and anonymous. The survey consisted of multiple choice questions with closed-response regarding influence of ultrasound role in making decision in patients with acute appendicitis (see Appendix). Responses were graded on a 5-point, ranging from high to low option. Only fully completed surveys were included in the analysis. The values are expressed as percentage values (n, %). The χ^2 test was used to compare responses to each question with control question responses. Control question responses were defined as the equitable distribution of expected in responses for each answer choice used as comparator. A *P* value

of <0.05 was considered significant. Statistical analyses were performed using the PASW version 18.0 (SPSS, Inc., IBM Company, Chicago, IL, USA).

RESULTS

In total, 100 responses were received and analyzed. All of respondents (surgeons and surgical residents) practiced at surgical departments of Aden city hospitals. There was wide variation in how surgeons responded to questions. In cases of certain clinical diagnosis of acute appendicitis, 38% of respondents were chose moderately high grade of ultrasound use in diagnosis ($P = 0.010$). The regarding decision discretion of surgeons, 38% of participants felt that sonographic findings were moderate grade of influence on their decision from to operate to not to operate ($P = 0.241$). Within their practice in those cases, 49% of surgeons reported that sonographic findings were moderate grade of matching with postoperative diagnosis ($P = 0.075$).

Table 1: Ultrasound parameters in certain clinical diagnosis of acute appendicitis

Parameters	Grades						P – value
	High	Moderately high	Moderate	Moderately low	Low	Total	
Ultrasound use rate	11%	38%	26%	10%	15%	100%	0.010**
Influence decision rate	10%	28%	38%	14%	10%	100%	0.241
Matching rate	4%	39%	49%	7%	1%	100%	0.075
** significant P – value <0.05							

In cases of uncertain clinical diagnosis of acute appendicitis, 45% of surgeons reported that sonographic findings were moderate grade of their elimination confusion in diagnosis and so in their opinions, it were sufficient to make decision to operate without further imaging need ($P = 0.037$). Within their practice in those cases, 54% of surgeons reported that sonographic findings were moderate grade of matching with postoperative diagnosis ($P = 0.022$).

Table 2: Ultrasound parameters in uncertain clinical diagnosis of acute appendicitis

Parameters	Grades						P – value
	High	Moderately high	Moderate	Moderately low	Low	Total	
Confusion elimination and Influence decision rate	8%	39%	45%	4%	4%	100%	0.037**
Matching rate	5%	34%	54%	6%	1%	100%	0.022**

** significant P – value <0.05

Within their practice, 44% of surgeons felt that diagnostic accuracy of sonographic findings were moderately high grade of operator dependent ($P = 0.002$). Whereas 44% of surgeons agreed that sonographic findings were moderate grade of reduced negative appendectomies ($P = 0.133$).

The surgeons reported that ultrasound timely diagnosis was moderately high grade of reduced complications such as perforation of appendix and shortened length hospital stay 40% ($P = 0.004$) and 35% ($P = 0.003$), respectively. In our survey, 55% of surgeons considered moderately high grade of the true diagnostic value of ultrasound was lies in detect other pathology for example gynecologic disorders in female patients and lymphadenitis in children ($P = 0.038$).

Table 3: Ultrasound outcomes parameters

Parameters	Grades						P – value
	High	Moderately high	Moderate	Moderately low	Low	Total	
Operator dependent rate	42%	44%	11%	3%	0%	100%	0.002***
Reduce negative appendectomy rate	6%	33%	44%	12%	5%	100%	0.133
Reduce complications rate	13%	40%	35%	10%	2%	100%	0.004***
Shorten hospital stay rate	15%	35%	30%	12%	8%	100%	0.003***
Detect other pathology rate	20%	55%	24%	1%	0%	100%	0.038**

***significant P – value <0.01
 ** significant P – value <0.05

DISCUSSION

The current local survey reflects individual practice of the surgeons in making their decisions with patients who are likely to have acute appendicitis. However, surgeons vary widely in their responses over the 10 questions, because there was no “right” answer.

Multiple previous reports have shown that ultrasonography, introduced as the first imaging modality in patients with suspected appendicitis (Chana, & Ahmad,2005; Tauro et.

al., 2009; Chen et. al, 2000; Scammell et. al, 2011; Mostbeck et. al, 2016; Malli et. al 2015; Shah, Schnatterbeck, & Michie,2010; Badi et. al, 2009). Nevertheless, opinions on its use are still divided. Some authors believe that it should be reserved for clinically dubious cases (Gaikwad, Auti, & Magare, 2017; Malli et. al 2015; Tiu et. al, 2004). Others advocate its routine use whenever acute appendicitis is suspected; pointing out that even the most typical clinical picture is often unreliable (Özdemir et. al, 2018; Tauro et. al., 2009; Mostbeck et. al, 2016; Shah et. al 2010; Sharma, Kasliwal, & Sharma,2007). Even if a confident diagnosis is made clinically preoperatively, our result showed 38% of surgeons chose moderately high grade of ultrasound use in diagnosis. Whereas in dubious cases, 45% of them chose moderate grade of use its for eliminated their confusion in diagnosis.

Several previous surveys have shown a range of sensitivity and specificity for ultrasound indicating the gross operator dependency of the final result of ultrasound Chana, & Ahmad,2005; Chen, et. al, 2000; Shah, et. al, 2010; Sharma, et. al, 2007; Pinto, et. al, 2013; Karabulut, et. al, 2016). Allaei et al. (2016) found that no difference in outcome if the examination was performed by experienced sonologists or beginners. In our survey, 44% of surgeons deemed that moderately high grade of diagnostic accuracy of ultrasound results were operator dependent.

Özdemir, et. al (2018) found that a diagnostic approach based only on history and clinical examination leads to an unacceptably high percentage of negative appendectomy. Several studies found that widely believed that preoperative using ultrasound help reduce negative appendectomy rate (Alessandro & Battista,2017; Khorasani et. al, 2003; Sandell, et. al, 2015; Kaneko & Tsuda, 2004; Badi et. al, 2009; Sharma, et. al, 2007; Seetahal, et. al, 2011). While Lee, Walsh, & Ho, (2001). reported that preoperative using ultrasound was not effective in reducing the negative appendectomy rate. Our study show, 44 % of surgeons believed that preoperative ultrasound examination has been moderate grade affect in reduced negative appendectomy rate. Reducing unnecessary operations is good for patients and for health care systems (Scammell, et. al, 2011; Vidmar, et. al, 2006).

More accurate and timely diagnosis of appendicitis can minimize the time to surgery, thus reducing appendix perforation and associated infectious complications and improving clinical outcomes. Conversely, time-consuming or unnecessary imaging (or other diagnostic workup) may delay surgery and increase the risk of complications (Khorasani et. al, 2003; Sandell, et. al, 2015; Tiu, et. al, 2004) [6, 9, 18]. In our survey, 40 % of surgeons agreed that preoperative ultrasound examination has been moderately high grade impact on reduced

complications. (Alessandro & Battista,2017; Elahifar, et. al, 2012; Gaikwa, Auti, & Magare,2017; Mostbeck, et.al, 2016; Badi et. al, 2009; Pinto, et. al, 2013).

Several studies confirmed that in case of using ultrasonography patients had the operation undertaken timely due to the additional evidence provided by the ultrasonography. Accordingly, ultrasonography in this category of patients has allowed timely intervention with overall presumed benefit of reduced hospital stay (Tauro, 2009; Alessandro & Battista,2017; Mostbeck, et.al, 2016; Vidmar, et. al, 2006; Ehrman & Favot, 2017). Note that, in our study, 35% of surgeons agreed that ultrasonography has been moderately high grade affect in shortened length of hospital stay.

An important additional advantage of ultrasound in acute appendicitis is the diagnoses of alternative conditions in abdomen mimicking acute appendicitis (Chana, & Ahmad,2005; Khorasani et. al, 2003; Elahifar, et. al, 2012; Vidmar, et. al, 2006; Sharma, et. al,2007; Pacharn, et. al, 2010). A variety of acute gastrointestinal, genitourinary, and gynecological pathologic processes are associated with clinical symptoms similar to that of appendicitis. Imaging with ultrasound, computed tomography and magnetic resonance are useful for identifying appendicitis and associated complications, as well as identifying alternative diagnoses for the patient's symptoms (Khorasani, et. al. 2003; Elahifar, Taheri, & Bighamian,2012; Mallin, et. al, 2015; Lee, et. al. 2001; Pacharn et. al, 2010). Ultrasonography is the primary and sometimes the only necessary imaging tool in the assessment of acute pelvic pain in women. The true value of ultrasound in female acute abdominal pain lies in its ability to detect gynecological disorders and effectively rule out other causes of acute abdominal pain that require surgical repair (Sharma, et. al, 2007). In our survey, found that 55% of surveyed surgeons believe that moderately high grade of the true value of sonography lies in detecting other pathology mimicking acute appendicitis.

If diagnosis tests do not affect surgeon decision making or provide prognostic information, they can increase costs without improving quality (Lee, et. al. 2001). As our study was meant to reflect daily surgical practice in Aden city-Yemen. Strengths of our survey include its first time in Yemen, to the best of our knowledge, there is no study previously published and sampling of surgeons across a range of experiences. Our study has the limitation that relatively small sample size and may not represent national sampling of surgeons. Factors such as the local surgical culture in which the surgeon was trained and prior experiences likely influence surgical decision making but are difficult to capture.

CONCLUSIONS:

In the absence of clear clinical guidelines, surgeons vary widely in their decision making regarding surgery, especially in cases of discretionary surgery. Ultrasound significantly affects on surgical decision making. Ultrasound helps surgeons to avoid a negative appendectomy in the diagnosis based only on typical clinical presentation cases as well as to avoid delays in diagnosis and surgery may lead to worse outcomes from appendiceal perforation in variable clinical presentation cases. Ultrasound timely diagnosis good impact on improves patient outcomes in terms of reducing the complications and the shortening length of hospital stay. Undoubtedly, those results mandate changes in surgical management decisions.

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APPENDIX:

In cases of certain clinical diagnosis:

1- What is the use rate of ultrasonography in the diagnosis?

High Moderately high Moderate Moderately low Low

2- What is the influence rate of sonographic findings on your decision from to operate to not to operate?

High Moderately high Moderate Moderately low Low

3- What is the matching rate of sonographic findings with postoperative diagnosis?

High Moderately high Moderate Moderately low Low

In cases of uncertain clinical diagnosis:

4- Particularly in children, women childbearing age in particular pregnancy, elder and obese patients. In such cases of real confusing for the surgeon. In which rate sonographic findings eliminate your confusing in diagnosis and it was sufficient to operate without further imaging needed?

High Moderately high Moderate Moderately low Low

5- What is the matching rate of sonographic findings with postoperative diagnosis?

High Moderately high Moderate Moderately low Low

Ultrasound outcomes:

6- The difference in accuracy of sonographic findings can be explained by the fact that ultrasonography is highly operator dependent. What is the operator dependent rate in the accuracy of sonographic findings?

High Moderately high Moderate Moderately low Low

7- Sonographic findings may helps to lower the rate of negative (unnecessary) appendectomy. What is the reducing negative appendectomy rate?

High Moderately high Moderate Moderately low Low

8- Ultrasonography timely diagnosis is reducing the complications rate, in particular perforated appendix. What is the reduce complications rate?

High Moderately high Moderate Moderately low Low

9- Ultrasonography timely diagnosis is shorter stay in hospital. What is the shorten hospital stay rate?

High Moderately high Moderate Moderately low Low

10- The true value of sonography lies in the ability to detect gynecologic disorders in female patients and effectively rule out other pathology such as lymphadenitis patients. What is the diagnostic value rate of ultrasonography in detected of that pathology?

High Moderately high Moderate Moderately low Low