Quick-Look Sonography (QLS): A Useful Addition To The Physical Exam Of Patients With Non-Traumatic Abdominal Pain

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Citation

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Abstract

Objectives: The purpose of this pilot study was to assess whether or not the use of four-view quick look sonography (QLS) by "novice" resident operators is a useful addition to the physical exam of patients presenting with non-traumatic abdominal pain.

Methods: This was a retrospective review of patients presenting with non-traumatic abdominal pain who underwent QLS as part of their physical exam, prior to studies by the department of radiology or laparotomy.

Results: 413 patients underwent QLS as part of their physical exam prior to department of radiology or operative evaluations. 55 residents performed QLS as part of their physical exam with an average of 6 QLS exams/resident (95% CI, 3-10) during the study period. Prior to the study period, no resident had performed more than five US exams.

Results of resident QLS for free fluid (FF) are shown below. No patient with FF requiring operative management was missed by EP-QLS.

12 of 12 patients with hydronephrosis were correctly identified with resident-QLS. There was one false positive for hydronephrosis, yielding a sensitivity and specificity for hydronephrosis of 100% (95% CI, 69.9-100) and 99.8% (95% CI, 98.4-100). 5 of 6 patients with renal cysts were correctly diagnosed by resident-QLS. There were no false positives for renal cyst, corresponding to a sensitivity and specificity for renal cysts of 83.3% (95% CI, 36.5-99.1) and 100% (95% CI, 98.8-100). Other abdominal findings of QLS are shown below.
Conclusion: QLS by "novice" resident operators appears to be a useful addition to the physical exam in evaluating patients presenting with non-traumatic abdominal pain. This is an aspect of the physical exam that is worthy of future studies.

INTRODUCTION

Figure 1

Free Fluid Detection	TP	TN	FP	FN
EP-QLS	101	297	5	10
Sensitivity	91.0% (95% CI, 83.7-95.4)			
Specificity	98.3% (95% CI, 96.0-99.4)			
Positive Predictive Value	95.3% (95% CI, 88.8-98.3)			
Negative Predictive Value	96.7% (95% CI, 93.9-98.3)			

Patients with abdominal pain can be among the most challenging cases seen in the ED. Among geriatric patients, the evaluation of abdominal pain is the most time consuming of all ED work ups, leads to high admission rates, and is accompanied by a significant number of return visits ([1]). Approximately 40% of patients presenting with abdominal pain are ultimately diagnosed with non-specific, non-operative abdominal pain ([2]). Thus, EPs are faced with the daunting task of accurately and efficiently identifying patients with “abdominal pain” who require further evaluation and emergent intervention.

One modality that has become invaluable in evaluating patients presenting to the ED is bedside ultrasound (US). It assists in ED diagnosis and clinical management, while

expediting treatment ([3,4]). This has been extensively in abdominal trauma using focused abdominal sonography for trauma (FAST) ([5,6]), which can be done in less than 5 minutes ([7]). Recently, the indications for ED US have been expanded to include non-traumatic abdominal pain ([3]).

The purpose of this pilot study was to assess whether or not the use of four-view quick look sonography (QLS) by "novice" resident operators is a useful addition to the physical exam of patients with non-traumatic abdominal pain.

METHODS

This was a retrospective review of patients with non-traumatic abdominal pain presenting to an urban, academic ED from April 2000 to March 2002. Patients were identified who had chief complaints of abdominal pain, nausea/vomiting, or first-trimester pregnancy-related symptoms and included if they underwent resident-QLS as part of their physical exam prior to formal radiographic or operative evaluation. Patients presenting with abdominal trauma or as resuscitations were excluded.

QLS was done using an Aloka SSD-1400 using a 3.5 MHz curved linear array probe to evaluate (A) the hepatorenal recess, (B) the splenorenal recess, (C) the subxiphoid pericardial window, and (D) the suprapubic window primarily for free fluid (FF). All residents were given a 2-hour large group lecture and demonstration prior to using QLS as part of the physical exam where they were instructed to grossly assess the quality of cardiac activity, the presence of hydronephrosis, and the presence of an intrauterine pregnancy with visualized fetal heart movement using the four veiws described above.

Patient files were reviewed with standardized data sheets and the results of resident-QLS were compared against subsequent department of radiology or operative evaluations. Operative findings were used as "gold standards" when available, otherwise department of radiology US was used for patients with ovarian, uterine, or gallbladder pathology or CT for patients with all other abdominal pathology. Chart review was done for 6-month follow up on all "false negative" resident-QLS via the hospital's computer database. Data was recorded using Microsoft Excel 97 and analysis was done using VassarStats. This study was approved at the IRB for our institution.

RESULTS

413 patients presenting with non-traumatic abdominal pain, nausea and/or vomiting, and/or first-trimester pregnancy-related symptoms were evaluated with resident-QLS as part of their physical exam before department of radiology or operative evaluations. 253 abdominal CTs and 136 US were done, 31 patients had operative evaluation only, and 35 patients had CT or US followed by operative evaluation.

55 residents performed QLS as part of their physical exam with an average of 6 EP-QLS exams/resident (95% CI, 3-10) during the study period. Prior to the study period, no resident had performed any US exam other than the FAST scan and no resident had performed more than five of them.

The final discharge diagnoses for the patients are listed in table 1. 111 patients had intra-abdominal FF with resident-QLS sensitivity and specificity of 91.0% (95% CI, 83.7-95.4) and 98.3% (95% CI, 96.0-99.4) (see tables 2,3). No patients with FF who required operative management were missed by resident-QLS.

Figure 2

Table 1: Final Diagnoses of patients with confirmatory studies

Final Diagnosis	# of pts (of 413 total)
AAA	15
Abd Pain, Other Cause *	74
Abd Pain NOS	124
Ascites	53
Gall stones/Cholecystitis	27
Hydronephrosis	12
Ovarian Cyst	14
Pelvic Inflammatory Disease	5
Pelvic Mass	9
Perforated Bowel	4
Pericardial Effusion	17
Renal Cysts	6
Renal Stones	14
Ruptured Ectopic	12
Small Bowel Obstruction	8
Tubal-ovarian Abscess	3
UTI/Pyelonephritis	16

- Other causes include diabetic gastroparesis, diverticular disease, hepatitis, liver cyst, mesinteric ischemia, pancreatitis, peptic ulcer disease, splenic infarct

Figure 3

Table 2: EP-QLS characteristics for FF in non-traumatic abdominal pain

Free Fluid Detection	TP	TN	FP	FN
EP-QLS	101	297	5	10
Sensitivity	91.0% (95% CI, 83.7-95.4)			
Specificity	98.3% (95% CI, 96.0-99.4)			
Positive Predictive Value	95.3% (95% CI, 88.8-98.3)			
Negative Predictive Value	96.7% (95% CI, 93.9-98.3)			

Figure 4

Table 3: Patients with "false negatives" for FF by EP-QLS

Pt	Study	Findings	Disposition	Final Diagnosis
1	CT	"mild pericardial effusion"	Discharged home	Pericarditis
2	US	"trace perinephric fluid"	Admitted	Acute Renal Failure with Uremia
3	CT	"misplaced G- tube" with "slight amount of fluid around site"	Admitted	Misplaced G-tube
4	CT	"trace amount of free fluid"	Discharged home	Ascites
5	TV US	"trace amount of fluid" in the pouch of Douglas	Discharged home	PID
6	CT	SBO with "small amount of perihepatic fluid"	Admitted	SBO
7	CT	"small amount of perisplenic fluid"	Admitted for observation	Abd Pain, uncertain etiology
8	TV US	"ruptured ovarian cyst" with "small amount of fluid" in the pelvis	Discharged home	Ruptured Ovarian Cyst
9	CT	"small pericardial effusion" and "pancreatic mass"	Discharged home	Pancreatic Cancer
10	CT	"mild peri-tubal fluid" concerning for "possible TOA"	Admitted	PID (No TV US done)

TV US – transvaginal ultrasound; PID – pelvic inflammatory disease; SBO – small bowel obstruction

12 patients had hydronephrosis, all of whom were correctly identified with resident-QLS (table 4). One patient without hydronephrosis was identified by resident-QLS as having "possible hydronephrosis" and considered a "false positive" for the sake of analysis, yielding a sensitivity and specificity for hydronephrosis of 100% (95% CI, 69.9-100) and 99.8% (95% CI, 98.4-100). Furthermore, 6 patients had renal cysts, 5 of whom were correctly diagnosed by resident-QLS. One patient with a 2cm renal cyst was identified as having a "possible renal cyst" with QLS and considered a "false negative", but there were no false positives. This corresponds to a sensitivity and specificity of resident-QLS for renal cysts of 83.3% (95% CI, 36.5-99.1) and 100% (95% CI, 98.8-100).

Figure 5

Table 4: Abdominal Findings of EP-QLS

Pathology	% Correctly Identified by EP-QLS
Ascites (n=53)	98%
Ascites with Negative Paracentesis for SBP (n=27)	100%
Ruptured Ectopic with FF (n=12)	100%
Hydronephrosis (n=12)	100%
Ovarian Cyst (n=14)	79%
Pelvic Mass (n=9)	89%
Pericardial Effusion (n=17)	94%
Renal Cyst (n=6)	83%

53 were diagnosed with abdominal pain due to "ascites" by a combination of radiography and clinical judgment. 52 were

correctly identified by EP-QLS (table 4). Furthermore, 27 patients underwent paracentesis to rule out spontaneous bacterial peritonitis, all of whom were correctly identified with resident-QLS.

12 of 12 patients with ruptured ectopic pregnancies were identified by resident-QLS as having FF and abnormal suprapubic views (table 4), while 8 of 9 patients with pelvic masses and 11 of 14 patients with non-ruptured ovarian cysts were correctly identified by resident-QLS. Since all female patients did not undergo transvaginal ultrasound for pelvic pathology, sensitivity and specificity were not calculated. Likewise, 16 of 17 patients with pericardial effusions were correctly diagnosed by resident-QLS with one false positive for pericardial effusion. Since all patients did not undergo definitive testing for pericardial effusion, sensitivity and specificity for not calculated.

DISCUSSION

This study found that resident-QLS allowed residents to recognize a number of abdominal pathologies subsequently identified by operative or department of radiology evaluations. This is significant as standard physical exam alone is neither sensitive nor specific for many causes of abdominal pain. Furthermore, we are unaware of any study in the literature assessing QLS as part of the physical examination in patients with non-traumatic abdominal pain.

Our findings are consistent with prior studies demonstrating an expanding role for EP-performed US ([3]). Three particular indications—pericardial effusions, obstructive uropathy/hydronephrosis, and intrauterine pregnancies—were supported by this study.

QLS parallels the FAST scan in assessing the (A) the hepatorenal recess (Morison's pouch), (B) the splenorenal recess, (C) the pericardial window, and (D) the suprapubic window and allowing operators a limited, but quick view of the liver, spleen, kidneys, bladder, uterus in females, and heart. Thus, one would expect that as operators gained more proficiency with FAST exams, they would also become more proficient at identifying gross abnormalities of the associated organs, not unlike clinicians being able to detect valvular pathology with repeated auscultation of the heart. This likely added to the utility of QLS in our study as FAST scans are a routine part of trauma evaluations at our institution.

Some may question the use of such a limited, non-specific extension of the physical exam when EPs are starting to perform more specific US exams to assess for particular pathologies such as cholelithiasis and abdominal aortic aneurysms ([3],[4]). The problem is not that better exams do not exist, but that the majority of practicing EPs are not trained to do these exams and the number of fellowships for such training is inadequate for current needs. Furthermore, such exams are more time consuming and require greater expertise. QLS, however, seems like a reasonable extension of the physical exam and is analogous to the FAST scan, which is already being used by a large number of EPs ([3]).

The finding that QLS is a useful addition to the physical exam by even relatively novice residents is not surprising. Shackford et al found that 10 exams led to a significant decrease in the error rate of non-radiologist clinicians performing FAST exams ([8]). Likewise, Smith et al were unable to detect an appreciable learning curve with FAST exams once residents performed 10 studies ([9]). Furthermore, Ma et al found that EPs could accurately perform FAST scans after 15 exams ([10]). This is consistent with data relating to the performance of US exams for cholelithiasis as well ([11]).

LIMITATIONS AND FUTURE QUESTIONS

There were several limitations to this study. First of all, a convenience sample was used. It is unclear how useful QLS would be if performed on all patients with non-traumatic abdominal pain. However, clinicians routinely omit portions of the physical exam (eg, rectal exams) that they do not deem relevant to the ED evaluation. This could be studied prospectively in patients with non-traumatic abdominal pain. Secondly, it seems intuitive that experience with the FAST exam would increase skill with QLS, but this was not assessed in this study. This may have introduced a “training effect” into our study and could be the focus of future studies. Third, formal radiographic studies varied among patients due to the many different imaging modalities available and variable potential causes of non-traumatic abdominal pain. However, since the purpose of our study was not to show equivalency to any particular test, we believe that the findings of our study would still be of interest to practicing EPs. At any given time, an EP may order different tests to assess for the same pathology (eg, US or CT for the detection of hydronephrosis). It may be that EPs in our study were influenced in their choice of subsequent further exams by QLS. This could be assessed prospectively in future studies. Finally, while resident-QLS

appears to augment the physical exam, it is unclear whether or not it improves time to definitive diagnostic testing, time to disposition, or time to treatment. We suspect that it would, but this should be assessed prospectively.

CONCLUSION

Quick look sonography (QLS) by "novice" resident operators appears to be a useful addition to the physical exam in evaluating patients with non-traumatic abdominal pain. Its findings appear to correlate well with a number of abdominal pathologies and could possibly be of value in determining the timing/urgency and choice of formal diagnostic testing. This is an aspect of the physical exam that is worthy of future studies.

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