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- 'docendo ac discendo' - 'by teaching and learning'

In this issue:

Foreword

Welcome to the latest edition of the International Journal of Clinical Skills (IJOCS), Volume 6, Issue 1, November 2012.

A research group in Saskatchewan, Canada discuss whether bowel sounds are reliable in the diagnosis of small bowel obstruction. Their evidence suggests that the auscultation of bowel sounds alone does not appear to be reliable in diagnosing this condition, presenting some interesting research data. Their work emphasizes one of the most important aspects of medical diagnosis – that 'each physical sign is only a portion of the bigger picture'.

Some our educational colleagues in Melbourne, Australia have conducted research regarding some of the most fundamental issues in medical practice: professionalism and ethics. They have focused on enhancing the understanding of current teachings of professionalism and ethics. Their research will no doubt aid better preparation of future graduates for a truly ethical and professionally rewarding career.

Mr Alun Yewlett and his orthopaedic team, Swansea, United Kingdom, discuss compartment syndrome – a clinical diagnosis which causes significant morbidity if not recognised and treated promptly. The authors present a clinical method for helping clinicians diagnose this potentially limb and life threatening condition. Could this be a significantly reliable method to allow an evolving compartment syndrome to be recognised early in its natural history?

This issue also includes a review of Alasdair K. B. Ruthven's book 'Essential Examination'. The aim of this book is to provide easy access to the key points of clinical examination for senior medical students and junior doctors. Professor Jean Ker (Professor of Medical Education, University of Dundee, Scotland) gives her expert analysis of what the book provides for its readers.

As always, your feedback is invaluable for the continued development of the International Journal of Clinical Skills – the only peer reviewed international journal devoted to clinical skills (e-mail: feedback@ijocs.org).

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International Journal Of Clinical Skills
P O Box 56395
London
SE1 2UZ
United Kingdom

E-mail: info@ijocs.org
Web: www.ijocs.org
Tel: +44 (0) 845 0920 114
Fax: +44 (0) 845 0920 115

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When are bowel sounds most reliable in the diagnosis of small bowel obstruction?

Ms Jennifer Struble BSc *
Final Year Medical Student

Dr Michael A J Moser MD MSc FRCS (Canada) +
Residency Program Director

* College of Medicine, University of Saskatchewan, Canada

+ Division of General Surgery, University of Saskatchewan, Canada

Correspondence:
Dr Michael A J Moser
Director of Post Graduate Medical Education
Department of Surgery
103 Hospital Drive
Saskatoon SK
S7N 0W8
Canada

E-mail: mike.moser@usask.ca
Tel: +1 (0) 3069662014
Fax: +1 (0) 3069667988

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Abstract

Background: A recent study by our group found that only 42% of recorded small bowel obstruction (SBO) bowel sounds were correctly identified by test physicians. Sound analysis revealed that some of the bowel sounds were very typical, while others were atypical, and hence rarely identified as SBO. The purpose of our study was to determine if 'typical' sounds are more commonly found in certain settings such as early versus late, or proximal versus distal, SBO.

Methods: Healthy volunteers (n = 10) or patients with radiological or laparotomy confirmed small bowel obstruction (n = 19) were enrolled as study subjects. Unselected recordings of bowel sounds from each subject were obtained using an electronic stethoscope. Twenty study physicians were then individually presented with 36 consecutive sound recordings and were asked whether each sound clip represented small bowel obstruction or normal subjects.

Results: Test physicians scored an average of 45% (16.2/36) correct answers. Intra-observer agreement, however, was excellent (85%, kappa = 0.696), suggesting that the recordings were of good quality and the test physicians were consistent. Intra-patient agreement was poor (59.29%, kappa = 0.117), suggesting that a patients' bowel sounds vary considerably even between recordings taken even just minutes apart. Listening for a full minute, as opposed to 30 seconds made no difference, and no difference was seen in correct answers whether the obstruction was proximal or distal, or early or late.

Conclusion: In conclusion, the auscultation of bowel sounds does not appear to be reliable in diagnosing SBO. Nor does it appear that 'typical' sounds are more common in certain settings such as early versus late, or proximal versus distal, SBO. Our study suggests that the reason may be that sounds, made by the obstructed bowels, vary greatly from one moment to the next.

Introduction

Classic training suggests that high-pitched tingling bowel sounds are a part of the clinical picture needed to diagnose small bowel obstruction. However, very few investigations have been conducted to validate this assumption. Many clinical examination techniques such as percussion and palpation have not been validated and those that have suggest that they are far from accurate, for example, percussion and palpation was found to be unreliable in the diagnosis of hepatomegaly [1].

A previous study by our group found that auscultation is useful in the diagnosis of small bowel obstruction and ileus, with 80% of physician diagnoses being correct based on bowel sounds alone. In that study, auscultation for small bowel obstruction had a high positive predictive value (PPV, 72.7%), however, the overall sensitivity was low (42.1%). While many 'obstructed' sound clips were correctly identified by 70-80% of the physician

test subjects, other 'obstructed' sound clips were identified correctly less than 33% of the time, which is what would be expected by chance alone in a test with three possible answers [2]. Furthermore, the typical and atypical SBO recordings had different sound characteristics. We hypothesized that there are circumstances in which "typical" small bowel obstruction sounds occur and that physicians are better able to diagnose bowel obstruction in these circumstances.

Methods

Patients

Healthy volunteers (n = 10), patients with proximal small bowel obstruction (n = 7), and distal small bowel obstruction (n = 12), which was confirmed by CT or laparotomy, were recruited. Patients classified as early (n = 6) were auscultated within 24 hours of onset of symptoms. Those classified as late (n = 13) were auscultated more than 24 hours after the onset of symptoms. Healthy volunteers did not have any previous history of gastrointestinal disease. During the recording of the bowel sounds, all the participants were laying in supine position with their hands resting comfortably at their sides. The stethoscope diaphragm was then placed on the patient's abdomen in the right lower quadrant. Studies have shown that it is unnecessary to listen in all four abdominal quadrants [3].

Equipment and software

Bowel sounds were recorded using an E-scope II® electronic stethoscope (Cardionics® Inc., Webster, Texas, USA) onto Audacity® Version 1.2.5 for Mac OS X. The E-scope® was set at maximum recording volume and on the breath sounds frequency mode. The performance of electronic stethoscopes and conventional stethoscopes has previously been found to be similar in the clinical setting [4]. Bowel sounds were recorded on two consecutive days; 30 second and 1 minute recordings on day 1, and a 30 second recording on day 2. Recordings were completed approximately two hours post-prandial at a project rate of 96 000 Hz. The recorded bowel sounds were arranged into a test of 36 consecutive audio clips; 8 clips of 60 seconds and 28 clips of 30 seconds were used in order to determine if the duration of auscultation plays a role in diagnosing SBO. Amongst the test clips 6 were duplicated to allow the determination of intra-observer variation. For another 7 patients, two different recordings from the same patient at different times were included to allow the determination of intra-subject variation.

Physicians

Twenty test physicians from various backgrounds (surgeons, internists, anesthetists, and family physicians) were recruited. A test consisting of 36 clips were blindly played to one physician at a time without any other clinical information, using Sony MDR V300 headphones in a quiet office. After listening to each audio clip, each physician would indicate on a questionnaire whether they thought the diagnosis was normal or obstruction.

Statistics

Data were analyzed using SPSS 9.0 for the chi-squared test and kappa statistics with weighted kappa statistics where appropriate.

Ethics

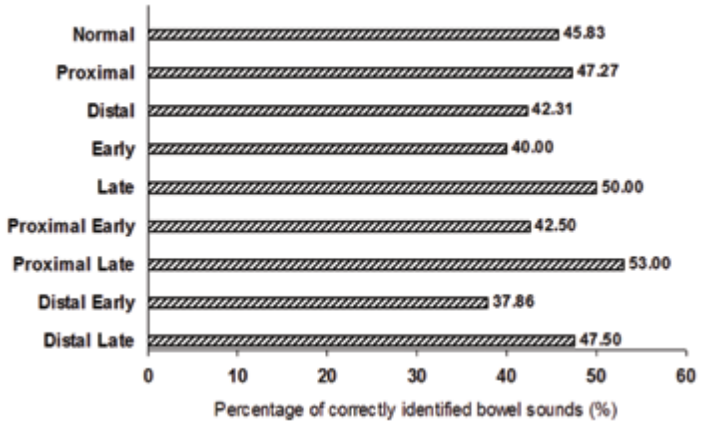
The research project was approved by the Biomedical Research Ethics Board (Bio-REB) of the University of Saskatchewan, Canada. Informed consent was obtained from the patients and normal subjects prior to recording.

Results

The physicians' average score was 45% (16.2 out of 36) with a range of 25-70% correct answers. Comparison between surgeons (n = 10) and non-surgeons (n = 10) showed no difference, (42.8% and 47.2% respectively, p = 0.261).

Normal (unobstructed) patients were identified correctly 45.8% of the time and patients with small bowel obstruction were identified 44.6% of the time with a positive predictive value of 62.2% (Figure 1). Therefore when a physician identified SBO, it was actually a SBO 62.2% of the time.

Figure 1: Percentage of correct answers by 20 test physicians for 36 bowel sounds recordings. No difference was seen in correct answers whether the obstruction was proximal or distal, early or late



The percentage of correct answers (sensitivity) was similar whether the obstruction was proximal or distal, early or late, or a combination of these (Figure 1).

There was no difference when physicians listened to bowel sound clips of either 30 seconds duration or 60 seconds duration as they were identified correctly 45.5% and 43.1% of the time respectively (p = 0.65).

Physician responses had a very good intra-observer agreement (85%, κ = 0.70), however, inter-observer agreement (45%, κ = -0.08) and intra-patient agreement (59.3%, κ = 0.12) were poor (Table 1). Furthermore, agreement between recordings done in the same patient only minutes apart was poor (62.2%, κ = 0.23). Kappa is a measure of agreement above that which would be expected by chance alone. A kappa value of 0 or less indicates that the observed agreement is the same as that expected by chance alone, and a kappa value of 1 indicates perfect agreement. To put these kappa values into perspective, a study examining the reliability of certain physical exam findings related to detection of aortic stenosis found that a loud systolic murmur heard at the second right intercostal space had a kappa value of 0.45 [5]. Another study, looking at the reliability of liver percussion to detect hepatomegaly, found an inter-observer agreement of only kappa = 0.17 – 0.33 [1].

Table 1: Intra-observer, inter-observer, and intra-patient agreement along with their respective kappa values

	% agreement	kappa value	Interpretation
Intra-observer	85	0.70	Very Good
Inter-observer	45	-0.08	Expect to see by chance
Intra-patient	59.3	0.12	Poor
Two minutes apart	62.2	0.23	Poor

Discussion

In this study we found that auscultation for the detection of small bowel obstruction (SBO) was not very useful at all, with accuracy similar to that obtained by guessing. The location of the obstruction (proximal versus distal) and the time since the onset of the obstruction (early versus late) did not affect the percentage of correct answers.

There was good intra-observer agreement (85%, kappa 0.696) suggesting that the recordings were good quality and that the physicians were consistent in making the same diagnosis from the same audio clip. The poor intra-patient variation hints that patients' bowel sounds likely change with time and this is supported by the poor agreement of physician responses to audio clips that were taken from the same patient only minutes apart.

The percentage of clips identified correctly was similar for 30 second recordings, as for 60 second recordings

Nonetheless, the positive predictive value of 62.2% for SBO is reasonable and comparable to that found for other physical exam techniques [1, 5]. When a physician thinks they have heard a SBO there is a reasonable chance the patient has an obstruction.

It is important, when using a test, that its accuracy is documented, so that we know how useful the results of the test are in clinical practice. This is what we have endeavoured to do for auscultation of bowel sounds. Our previous study looked at distinguishing among 3 possible 'diagnoses': obstruction, normal, and ileus. The overall percentage of correct answers was about 80%, but this is due to the fact that auscultation in cases of ileus was quite sensitive and specific, skewing the overall results. Nonetheless, the results from this study agree with those from our previous study. The percentage of SBO sounds correctly identified was 42.1% (44.6% in the current study), and the PPV for SBO sounds was 72.7% (62.2% in this current study).

Our study was limited by the fact that the results are only as valid as the sound recording is a true representation of the original sounds. The high resolution of the sound and the feedback from the test physicians would suggest the sound quality was very good. The intra-observer agreement supports this assertion. There is a possibility of fatigue due to the multiple test clips a test physician had to listen to; however, the percentage of correct answers in the first 18 clips did not differ from the correct answers in the second 18 clips, making this unlikely.

Our study looked at the utility of bowel sounds used in isolation to make a diagnosis. Of course, in clinical practice, bowel sounds are not used in isolation: the clinician is provided with a history, palpation and percussion of the abdomen, blood tests, and even X-rays. Even without the use of a CT scan, the use of bowel sounds combined with these other 'tests' must surely raise the PPV above 62.2%.

Conclusion

We found that auscultation of bowel sounds is, by itself, only somewhat useful in the assessment of small bowel obstruction. This is similar to many other physical examination tests; each physical sign is only a portion of the 'big picture' needed to arrive at a correct diagnosis.

Declarations

The authors have no financial or other interests to declare in relation to this paper.

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Author Information

Jennifer Struble is a medical student at the University of Saskatchewan who completed the study as part of a Dean's Honor List Summer Project. The project won honorable mention at the College of Medicine's research day and also the first place medical student prize at the Department of Surgery Resident Research Day. **Michael Moser** is Residency Program Director for the General Surgery Program at the University of Saskatchewan and sits on the national board of the Canadian Society for Clinical Investigation. He has previously published on the topic of bowel sounds and maintains a healthy dose of skepticism when it comes to tests.

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