Victorian Institute of Forensic Medicine

Clinical Communiqué

VOLUME 5. ISSUE 2.
JUNE 2018 Edition
ISSN 2204 - 0099

CONTENTS

PUBLICATION TEAM

Address: Department of Forensic Medicine, Monash University,
Victorian Institute of Forensic Medicine
65 Kavanagh St, Southbank VIC 3006

FREE SUBSCRIPTION

The Department of Forensic Medicine Monash University and the Victorian Institute of Forensic Medicine will publish the CLINICAL COMMUNIQUÉ on a quarterly basis. Subscription is free of charge and will be sent electronically to your preferred email address.

If you would like to subscribe to the CLINICAL COMMUNIQUÉ, please go to:

http://www.vifmcommuniques.org

Next Edition: September 2018

EDITORIAL

Welcome to the June 2018 edition of the Clinical Communiqué. In this edition, we present three cases of patients who died shortly after being assessed and discharged from an emergency department. In each case, an evolving abdominal problem was missed, and the symptoms were attributed to other, less critical causes. Fluctuating signs were misinterpreted, investigative abnormalities were not fully appreciated, and ultimately, diagnoses of life-threatening conditions were missed.

A common mantra in medicine is beware the diagnosis of constipation in the elderly patient with abdominal pain. As two of the cases in this edition highlight, a verse named 'viral gastro' could be added to that mantra - beware the diagnosis of viral gastroenteritis in patients with severe abdominal pain and high fevers.

In our December 2014 edition of the Clinical Communiqué, we presented three cases where the lessons to be learned related to clinical deterioration, and the failure to recognise or respond appropriately to early warning signs. There, we looked at heuristic thinking in clinical decision-making. In this edition, we revisit the challenges of clinical decision-making and remember that patients do not always present to hospital with 'classic' symptoms and signs for their conditions.

We are very pleased to present two new case summary authors, Dr Guy Sansom and Dr Suzanne Doherty, both emergency physicians, who know only too well the difficulties faced daily by clinicians working in busy emergency departments. Our expert commentary has been written by Dr Carmel Crock, an emergency department director, and the chair of the Australasian College for Emergency Medicine's Quality subcommittee. Carmel has expertise in incident monitoring and patient safety, and is a founding member of the Society to Improve Diagnosis in Medicine in the USA. She also sits on the editorial board of the journal Diagnosis. Her compelling commentary explores the concept of cognitive bias and the debiasing strategies that can be employed to make the diagnostic process safer. Her recommended resources should be added to every clinician's reading list to gain an armoury of skills for mitigating diagnostic errors, and gaining a deeper understanding into our work performance.

Another key message from the cases presented in this edition is the importance of incorporating clinical governance systems into hospital processes and patient care. The coroners looked at the environment in which the missed diagnoses occurred, and made recommendations that targeted the systems within which the emergency staff worked. The focus should not be on 'how do we make sure that an individual does not make that error again', rather, on 'how do we all improve and benefit?'

Finally, it is important to remember that while we all need good systems around us to improve patient safety, we cannot be complacent about our individual clinical practice. Humans make errors and systems fail, so we each need internal safeguards in place to prevent adverse events from occurring. We must look within ourselves and strive each day to challenge the veracity and content of our differentials. Reflecting on our cognitive biases and the systems constraints that might have influenced our decision-making, will allow us to be better clinicians for our patients.

CASE #1 A TALE OF DISTENSION AND DEPRESSION

Case Number: 2011/3125 Qld

Case Précis Author:
Dr Suzanne Doherty
MB BCh BAO, FACEM

CLINICAL SUMMARY

Mr CP was a 69 year old male who presented to a major metropolitan hospital after his family called paramedics with concerns of his general deterioration, increased alcohol use, reduced oral intake, distended abdomen and incontinence. Mr CP had a number of comorbidities and was often reluctant to seek medical assistance.

Mr CP arrived at hospital at approximately 1pm where the treating doctor and a junior medical officer noted that he had hiccups, abdominal distension and discomfort, and soft stools with slight incontinence of faeces. After an abdominal x-ray and blood tests were performed, he was diagnosed with constipation and treated with an enema. His care was then handed over to an intern on the next shift who documented that Mr CP had an elevated white cell count and was feeling low. His x-ray did not definitively show an obstruction. The intern documented that Mr CP was eating less and drinking more and had "given up". The working diagnosis was constipation with overflow and depression. His presentation was discussed with the emergency consultant who agreed with the management plan. He was given a second enema with good effect. Mr CP was then reviewed by the psychiatry services who diagnosed him with adjustment disorder, depression, and alcohol abuse. He was discharged home around midnight.

Mr CP returned to the ED two days later on advice from an Occupational Therapy staff member for an Older Person's Evaluation Referral and Assessment (OPERA) review following concerns by his community care worker that he was not coping at home. Mild abdominal pain, constipation and some diarrhoea were noted by the emergency doctor, along with difficulty in obtaining a clear history from Mr CP, who appeared to be in denial of his health issues. Blood tests, an abdominal x-ray and an abdominal CT scan were ordered.

Mr CP was admitted to a medical ward under the OPERA team. A short while later, Mr CP complained of severe abdominal pain and developed a temperature of 37.9 degrees Celsius. It was felt that there was no evidence of an evolving acute abdomen as there was no guarding or rigidity on examination, evidence of obstruction or perforation on x-ray.

Later that day on the surgical ward round, Mr CP was found to be critically unwell with a low blood pressure, high heart rate, poor urine output, and a rigid and guarded abdomen although he denied pain or tenderness.

The case was discussed with the surgical registrar and later, with the medical consultant, and it was decided that there was no need for an urgent abdominal CT that day.

Mr CP deteriorated that evening. The surgical registrar reviewed him and after a discussion the surgical consultant came in to review him also. A diagnosis of possible diverticulitis was made. Overnight Mr CP remained unwell and was treated with fluid boluses. He was transferred to the surgical ward in the morning, where a plan was made to continue antibiotics, intravenous fluids and to await the CT scan which was booked for that day. Two hours later Mr CP was noted to have a high heart rate and respiratory rate. He had a grossly distended abdomen, however no tenderness, guarding or rigidity. The CT scan was pending and his management was unchanged.

Later that day on the surgical ward round, Mr CP was found to be critically unwell with a low blood pressure, high heart rate, poor urine output, and a rigid and guarded abdomen although he denied pain or tenderness. After a discussion with the family, it was agreed that Mr CP was not for resuscitation, surgical intervention, or intensive care admission. The abdominal CT was cancelled due to the decision that Mr CP was not for surgery. Mr CP died later that day despite ongoing non-operative management for his suspected diverticulitis.

ACKNOWLEDGEMENTS

This initiative has been made possible by collaboration with the Department of Forensic Medicine (DFM), Monash University, Victorian Institute of Forensic Medicine (VIFM) and Victorian Managed Insurance Authority (VMIA).

FEEDBACK

The editorial team is keen to receive feedback about this communication especially in relation to changes in clinical practice. Please email your comments, questions and suggestions to:

cc@vifmcommuniques.org

CASE #1 A TALE OF DISTENSION AND DEPRESSION (CONTINUED)

PATHOLOGY

A death certificate was completed at the time of death, where the cause of death was listed as perforated bowel/ septicaemia as a result of diverticulitis.

INVESTIGATION

Mr CP's family made a complaint to the Health Quality and Complaints Commission (HQCC) as they felt that his abdominal illness should have been diagnosed on his first presentation to hospital. The HQCC considered that the matter constituted a reportable death so approximately 16 months after Mr CP died, his case was brought to the attention of the coroner.

His abdominal x-ray showed early small bowel obstruction suggesting possible ischaemic gut or diverticulitis, however this was not reported until the next day.

Australian Health Practitioner Regulation Agency (AHPRA) and the hospital were also notified on the basis of concerns about the treatment or failure to treat at a number of levels. The hospital conducted a Root Cause Analysis (RCA), and APHRA investigated the performances of various doctors involved.

As part of the HQCC, hospital and AHPRA investigative processes, independent expert opinions were obtained. The investigations found that on Mr CP's initial presentation to hospital there were a number of signs of serious illness: a high respiratory rate, low oxygen saturations, an elevated white cell count, a low albumin and an irregular pulse. His abdominal x-ray showed early small bowel obstruction suggesting possible ischaemic gut or diverticulitis, however this was not reported until the next day. Mr CP was looked after by various junior doctors at the time of his initial presentation to hospital, and he was discharged home without the supervising ED consultant being notified as it was not the policy at the time to do so.

CORONER'S FINDINGS

The coroner concluded that Mr CP was unwell at the time of his first presentation to the hospital. There were several factors which should have led to further investigation and admission at that stage. The RCA performed by the hospital made recommendations to help prevent a similar episode in the future. Various medical practitioners' performances were reviewed by AHPRA and although unsatisfactory professional performance was described, a decision was made that no further action was warranted. Given these developments, it was decided that an inquest was not necessary.

It is worth highlighting that in the older population, clinical signs in an abdominal examination are very unreliable, and the absence of clinical findings should not be used to exclude the presence of serious abdominal pathology.

AUTHOR'S COMMENTS

There were a number of red flags which were missed at the time of Mr CP's initial presentation. Given his history of being a person who frequently declined medical assistance and exhibited denial about his symptoms, one could presume he was an unreliable historian. This, combined with the presence of abnormal vital signs, his age, and an unconvincing history of constipation, should have warranted timely investigation with a CT abdomen and a surgical review. This may have provided an earlier diagnosis and altered the subsequent chain of events.

It is worth highlighting that in the older population, clinical signs in an abdominal examination are very unreliable, and the absence of clinical findings should not be used to exclude the presence of serious abdominal pathology. The utilisation of CT can significantly alter the clinical management decisions for these patients.

RESOURCES

Esses et al. Ability of CT to alter decision making in elderly patients with acute abdominal pain. *Am J Emerg Med* 2004; 22(4):270-272.

KEYWORDS

Abdominal pain, constipation, missed diagnosis, CT, diverticulitis, emergency department

CASE #2 WELL BETWEEN EPISODES

Case Number: 391 TASCD 2014

Case Précis Author:
Guy Sansom
MBBS, FACEM

CLINICAL SUMMARY

Ms CI was a 59 year old woman with a past history of successfully treated cervical cancer, and ongoing hypertension and depression managed with medication. Early one evening, having not passed stool for two days, she became anxious while attempting to open her bowels on the toilet. An ambulance was called, but she was not transported to hospital. The paramedic noted that she had "active" bowels and was on Lomotil (diphenoxylate hydrochloride and atropine sulfate, an anti-diarrhoeal agent), and had been hyperventilating but her symptoms were settling. An hour later however, they were recalled with Ms CI describing new abdominal pain, vomiting and diarrhoea which had commenced after eating a meal of chicken. She was transported to hospital and required Penthrane as analgesia.

Ms CI arrived at the emergency department (ED) with a temperature of 39.8 degrees Celsius, pulse 140 beats per minute, blood pressure 123/73mmHg, an oxygen saturation level of 96% on room air, and a Glasgow Coma Score of 14/15. Her pain level was rated 8 out of 10.

The blood results showed Ms CI's white cell count to be low (3.1, normal = 3.5 - 11.0) with a left shift and vacuolation. Her C-Reactive Protein (CRP) was within normal limits.

The emergency doctor recorded that she had abdominal pain bilaterally with mild voluntary guarding but no rebound tenderness. She was considered a poor historian, would not make eye contact with him, and appeared to give "delayed" responses. Blood tests were arranged and she was given an anti-emetic, an anti-spasmodic, morphine, paracetamol, and a litre of intravenous fluids. At that point, the working diagnosis was viral gastroenteritis with a secondary diagnosis of delirium due to high fever. Sepsis had not been "ruled out" as a diagnosis.

The blood results showed Ms CI's white cell count to be low (3.1, normal = 3.5 - 11.0) with a left shift and vacuolation. Her C-Reactive Protein (CRP) was within normal limits. The bilirubin level was elevated as was the anion gap.

She was incontinent of faeces on one occasion but not long after reported that she was feeling much better and was keen to go home.

The blood results coupled with Ms CI's improved clinical condition were interpreted by the emergency doctor as being inconsistent with sepsis. She was permitted to be discharged and left the hospital two and a half hours after arrival with the direction that she should return if her condition changed or did not improve.

Nine hours after discharge, Ms CI was found in a semi-sitting position in her hallway. She was unresponsive, and despite the attempts of an ambulance crew, she could not be revived.

The expert acknowledged that gastroenteritis and sepsis are illnesses which, in some cases, can be difficult to distinguish.

PATHOLOGY

A post-mortem examination was conducted which revealed copious purulent fluid within the abdomen and extensive colonic diverticuli. The forensic pathologist considered the likely cause of death to be sepsis complicating acute peritonitis arising in the setting of extensive diverticular disease of the sigmoid. Significant contributing factors were aspiration of gastric contents and hypertensive heart disease

INVESTIGATION

The focus of the coronial investigation was on the failure to diagnose sepsis and the decision to permit discharge. The coroner received reports from the staff involved in the care of Ms CI, the ambulance service, and the general manager of the hospital. An expert opinion was provided by the medical adviser to the coroner. The expert acknowledged that gastroenteritis and sepsis are illnesses which, in some cases, can be difficult to distinguish.

With the benefit of hindsight there were features of the presentation which should have increased suspicion of sepsis as the cause (severe pain, high fever, tachycardia, mode of onset, left shift with vacuolated leucocytes, and the elevated bilirubin). The expert also advised the coroner that in patients with sepsis it is not uncommon for the person to look and feel improved between septic episodes.

These cases are easier to diagnose in retrospect but serve as a reminder that disease progression, even when acute, is not always linear.

CORONER'S FINDINGS

The coroner commented that:

"This is another in a series of recent coronial cases investigated by me where a person has died because of a failure to make a timely diagnosis of sepsis. This leads me to again remind the medical fraternity that sepsis is a life-threatening condition which is often difficult to diagnose because it can present in multiple circumstances and because of a tendency for its signs to fluctuate. Its diagnosis requires close vigilance of the patient's vital signs and an understanding that particular changes or fluctuations in those signs may be explained by sepsis."

A public inquest was not held as it was felt that no further significant information would be obtained.

AUTHOR'S COMMENTS

These cases are easier to diagnose in retrospect but serve as a reminder that disease progression, even when acute, is not always linear. It is also a reminder that normal CRP levels do not exclude serious pathology, and that with increasing age, patients with peritonitis may only exhibit vague tenderness without classic rigidity, rebound or guarding on abdominal examination.

KEYWORDS

Sepsis, diverticular disease, abdominal pain, peritonitis, missed diagnosis, emergency department

CASE #3 MISSING THE BLEEDING POINT

Case Number: 29/15 WA

Case Précis Author:
Dr Nicola Cunningham
B.Med, MForensMed, FFCFM (RCPA), FACEM

CLINICAL SUMMARY

Mr YW was a 70 year old male who was generally well, but had a significant past medical history of type 2 diabetes, chronic renal failure, hypertension, and a previous stroke. His medications included aspirin and metoprolol (a beta-blocker).

He felt unwell one afternoon and passed a loose black stool, which his wife knew to mean that it had blood in it. She drove him to a private hospital emergency department (ED) and called their son to meet them there. On arrival, Mr YW was assessed by the triage nurse, and the possibility of melaena with symptoms of dizziness was recorded in the notes. Mr YW was seen approximately 90 minutes later by a senior emergency registrar who was also told about the black stool and dizziness. On further questioning, Mr YW denied passing fresh blood, or experiencing nausea, vomiting, pain, or fevers. His pulse was 92 beats per minute and the remaining vital signs were within normal limits. The presence of dark stool without fresh blood was confirmed on digital rectal examination. Blood tests were sent off for Mr YW, which revealed the following abnormalities: Haemoglobin 92 g/L (normal 122 to 170); Creatinine 208 mcmol/L (normal 40 – 120) and; Urea 32 mcmol/L (normal 3 – 8). Previous results were not available for comparison. The registrar made a diagnosis of infective gastroenteritis with dehydration and spoke to the emergency consultant-in-charge to seek agreement that CT imaging was not required.

Mr YW was told to take anti-diarrhoeal medication as needed, and to return to the hospital if he felt unwell. He was advised to see his general practitioner to arrange an endoscopy if the dark stool persisted. He was discharged home that evening, approximately three and a half hours after he presented to the ED.

That night, Mr YW again passed dark stools, and remained unwell throughout the next day.

At about midnight the following night, his wife found him sitting up in bed, sweaty and unwell, but he would not agree to returning to the hospital. Three hours later, he tried to get up from the bed and collapsed onto the floor. The paramedics were called but were unable to revive him. Mr YW was pronounced dead at the scene.

PATHOLOGY

A post-mortem examination revealed blood throughout the gastrointestinal tract. There were two small ulcers in the stomach, one of which had eroded into a large artery at its base. The cause of death was listed as gastrointestinal haemorrhage in a man with gastric ulcers.

INVESTIGATION

The case proceeded to inquest and the registrar and consultant were called to give evidence. The focus of the inquest was the quality of the medical care provided to Mr YW during his ED visit. The coroner obtained independent expert evidence from a senior emergency medicine consultant with expertise in patient safety. Mr YW's son also gave evidence at the inquest.

The expert tendered a report to the coroner detailing the presenting features of gastroenteritis. A number of pertinent diagnostic issues were highlighted in the report, including:

- An elevated pulse in the presence of metoprolol, is very unusual, and consistent with dehydration;
- The absence of melaena does not exclude gastrointestinal haemorrhage;
- The level of urea was out of proportion to the creatinine, consistent with a significant gastrointestinal bleed but not with chronic renal failure;
- The available history, examination and investigation findings was adequate to make a clinical diagnosis of probable gastrointestinal haemorrhage;
- The absence of nausea, vomiting, recurrent diarrhoea, colicky abdominal pain and fever made infectious gastroenteritis unlikely.

The registrar gave evidence that since Mr YW's death, he had researched the disease process and reflected on his decision-making. He admitted that there were gaps in his knowledge at the time and he should have made a diagnosis of gastrointestinal haemorrhage.

The consultant explained that if he been made aware of the triage notes and the blood test results, he would have had a high suspicion for gastrointestinal bleeding and advised transfer to a tertiary hospital for endoscopy.

Mr YW's son recalled his concern about how unwell his father looked in the ED, and how unhappy he had been with the registrar's decision to discharge his father. He had questioned the possibility of bleeding and wanted his father to be admitted to hospital. He told the coroner that the staff reassured him that his father just needed to rest, and described his father refusing to let his son take him to another hospital for further assessment, believing that the "doctors knew what they were doing".

The expert stated that although the standard of care given to Mr YW was lacking, it was not care that was provided by the emergency registrar alone. Although the registrar would be expected to manage cases independently, the error that was made was about "flawed decision-making rather than incompetence". Additionally, the role of the consultant-in-charge in Mr YW's case was one of "oversight rather than direct supervision". The expert acknowledged that the registrar was not able to view previous details about Mr YW and identified the need for clinicians to have ready access to past medical records and investigation results to assist in their decision-making. The expert also recommended the implementation of clinical governance systems to reduce diagnostic errors in the ED.

CORONER'S FINDINGS

The coroner concluded that Mr YW's condition was incorrectly diagnosed, and as a consequence, was left to progress untreated. The coroner found that had Mr YW received appropriate care, he would have not died when he did, so death occurred by way of misadventure. The coroner made a recommendation to the Department of Health to identify ways in which emergency departments could access patients' health information from all sources in a timely manner.

KEYWORDS

Missed diagnosis, gastrointestinal haemorrhage, stomach ulcer, emergency department, melaena, medical records

EXPERT COMMENTARY:

REFLECTIONS ON DIAGNOSTIC ERROR – MAKING THE DIAGNOSTIC PROCESS SAFER

Dr Carmel Crock
FACEM, B.Litt.
Director, Emergency Department
Royal Victorian Eye and Ear Hospital

"A diagnosis is a judgement characterised by uncertainty and probabilistic reasoning – it is seldom definitive at the initial point of care." Gurpreet Dhaliwal.

"Absolute certainty in diagnosis is unattainable, no matter how much information we gather, how many observations we make, or how many tests we perform. A diagnosis is a hypothesis about the nature of a patient's illness…" Jerome Kassirer.

Diagnostic error in medicine occurs at a substantial rate, thought to be in the range of 10-15%. In 2015, the Institute of Medicine (now the National Academy of Medicine) published a landmark report *Improving diagnosis in healthcare* which stated, *"Improving the diagnostic process is not only possible, but also represents a moral, professional and public health imperative."* Strategies to reduce diagnostic error need to address both the systems and cognitive contributions to error, which are commonly inseparable.

Documenting an accurate clinical history, physical examination and test results, with explanations of any abnormalities is critical.

These three compelling coroners' cases involving abdominal presentations and resulting in death following diagnostic error highlight the iterative and highly complex nature of the diagnostic process and the inherent uncertainty in diagnosis. The diagnostic process involves gathering information (clinical history, physical examination and testing), integrating and interpreting this information, then creating a working diagnosis, which may be a list of differential diagnoses. This process involves hypothesis generation and continuous refinement of diagnostic possibilities.

Documenting an accurate clinical history, physical examination and test results, with explanations of any abnormalities is critical. It is important to ensure our documentation reflects our thinking about a clinical problem. Abdominal symptoms and signs may wax and wane over time and apparent improvement in symptoms does not always herald improvement in the patient's condition. Furthermore, our confidence in a diagnosis does not correlate well with our diagnostic accuracy.

Awareness of the common cognitive biases and heuristics that affect our thinking and contribute to diagnostic error is the first step towards addressing them.

Dual process theory describes two distinct modes of reasoning and decision-making under uncertainty that apply to clinical decision-making: System 1 thinking or pattern recognition, which is fast, intuitive and driven by mental shortcuts (heuristics) and is largely unconscious; and System 2 or analytic thinking which is slow, deliberate and under conscious control.

Clinicians move between these two systems, depending on whether they are experts or novices, and depending on the complexity of a case and ambient conditions, such as time pressures, fatigue, and cognitive overload. System 1 thinking is more vulnerable to error. Awareness of the common cognitive biases and heuristics that affect our thinking and contribute to diagnostic error is the first step towards addressing them.

Cognitive bias mitigation involves the deliberate switching from intuitive to analytic thinking and the conscious use of debiasing strategies. Graber, Franklin and Gordon (2005) emphasize that faulty synthesis of the information that we gather, or errors in "putting it all together" is the commonest cause of cognitive error. The most prevalent type of faulty synthesis is 'premature closure', which appears to have been a factor in the three cases and will be discussed below.

Other common types of faulty synthesis of information include underestimating the salience of a finding, faulty interpretation of a test result, failure to order an appropriate test, and failure to consult.

Premature closure involves the failure to consider other possibilities once an initial diagnosis has been reached. Often, once a diagnostic label is placed, our critical thinking stops. One debiasing strategy is the creation of a differential diagnosis list, and actively documenting why a diagnosis is considered likely or unlikely. This can help safeguard against accepting a diagnosis before it has been verified. Some authors have promoted the use of the term "not yet diagnosed", rather than applying a diagnostic label which may gather momentum.

Another debiasing strategy to prevent premature closure entails ruling out worst-case scenarios. Listing and actively ruling out worst-case scenarios and "don't miss diagnoses" is particularly important in abdominal presentations, due to the often subtle and variable nature of symptoms and signs.

Incorporating diagnostic checklists into both medical education and the clinical workflow could help reduce diagnostic error.

This strategy can reduce the risk of serious pathology being overlooked. The practice of taking a diagnostic 'timeout' is advocated by medical educators. This may involve consideration of the opposite ("Why can't this be something else?"), using 'prospective hindsight' ("What would happen if our diagnosis was wrong?"), or using decision support tools.

Use of both a General Checklist for Diagnosis and Disease-Specific Cognitive Forcing Checklists have been proposed to reduce our susceptibility to cognitive biases. Checklists are used by other high risk, high reliability professions, such as aviation. Incorporating diagnostic checklists into both medical education and the clinical workflow could help reduce diagnostic error.

Alongside individuals' cognitive biases, systems contributions to diagnostic error must be addressed.

The diagnostic process occurs within a work system, composed of diagnostic team members, tasks, technologies and tools, and organisational factors. Diagnostic team members include supervisors, other doctors, nurses, pathologists, radiologists and most importantly the patient and their family. Optimal communication and collaboration between these team members is crucial. Breakdowns in communication and poor clinical handover contribute to diagnostic error.

Recognising the critical role of the patient and their family and ensuring they understand the diagnostic process is essential. Patients and families need to be engaged in the diagnostic process and not be considered passive recipients of a diagnosis.

There is clear evidence that availability of expertise, including real time reporting of medical imaging reduces diagnostic errors.

They should be encouraged to question clinicians and ask "what else could it be?" as well as being given copies of their discharge summaries and clear instructions for follow-up. Patient resources such as a Checklist for Getting the Right Diagnosis have been produced. Schiff (2014) has called for a paradigm shift in diagnosis, with a move towards systematic, proactive feedback and follow-up of patients, with the health service contacting patients, rather than waiting for patients to call or represent if not better.

Other systems contributions to diagnostic error to be addressed include the levels of supervision for junior doctors, unsafe staffing levels, and problems with electronic medical record usability that may contribute to cognitive overload. Shift work and rostering practices resulting in sleep deprivation, noise and interruptions all affect clinical decision-making. There is clear evidence that availability of expertise, including real time reporting of medical imaging reduces diagnostic errors. Furthermore, systems that ensure timely follow-up of test results and reliable test result communication are essential. Local policies, procedures and guidelines should support targeted access to expertise; for example, ensuring consultant opinions for high risk presentations such as the elderly with abdominal pain.

Availability and the incorporation of clinical practice guidelines into standard practice can enhance diagnostic performance.

The diagnostic process is a team-based activity requiring effective communication and collaboration among multiple clinicians, diagnostic services and the patient. Understanding diagnosis as a complex process that evolves over time, being affected by cognitive biases and complicated work systems, can help us to develop comprehensive strategies to reduce diagnostic error and make the diagnostic process safer and more reliable.

RESOURCES

Croskerry P. Context is everything or how could I have been that stupid? *Healthc Q* 2009;12 Spec No Patient: e171– e176.

Daniel M, Khandelwal S, Santen SA, Malone M, Croskerry P and Chen E. Cognitive Debiasing Strategies for the Emergency Department. *AEM Education and Training* 2017; 1: 41-42. doi:10.1002/aet2.10010.

Ely JW, Graber ML, Croskerry P. Checklists to reduce diagnostic errors. *Acad Med.* 2011; 86: 307-313.

Graber ML, Franklin N, Gordon R. Diagnostic Error in Internal Medicine. *Arch Intern Med.* 2005; 165(13): 1493–1499. doi:10.1001/archinte.165.13.1493.

National Academies of Sciences, Engineering, and Medicine. 2015. Improving Diagnosis in Health Care. Washington, DC: The National Academies Press. https://doi.org/10.17226/21794.

Schiff GD. Diagnosis and diagnostic errors: Time for a new paradigm. *BMJ Qual Saf* 2014; 23: 1-3.

Trowbridge, R. (2008). Twelve tips for teaching avoidance of diagnostic errors. *Med Teach* 2008; 30(5): 496-500. doi: 10.1080/01421590801965137.

Wears RL. What makes diagnosis hard? *Advances in Health Sciences Education* 2009. doi:10.1007/s10459-009-9181-3.