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Guest Editorial

by Violet Kieu

'Diagnosis is not the end, but the beginning of practice.'
Dr Martin Fischer, physician (1879-1962)

Welcome to the October 2019 edition of the new-look Future Leaders Communiqué. This edition will explore the theme of 'diagnostic errors', that is, where a diagnosis is missed, inappropriately delayed, or wrong [1], particularly in an obstetric patient.

While not all doctors work in a maternity setting, a pregnant patient may require care from different types of doctors, working in fields such as surgery, medicine, psychiatry, anaesthetics and general practice. There is crossover and overlap between obstetrics and the other clinical specialties. Specifically, the Australasian College for Emergency Medicine in their Quality Standards guideline states that care should consider the special requirements of maternity patients, with respect to environment, equipment and access to consultation [2].

This is important given the number of women who become mothers each year. Australian Institute of Health and Welfare (AIHW) report 310,247 women gave birth in Australia in 2016, an increase of 12% since 2006 (277,440 women). The rate of women giving birth was 62 per 1,000 women of reproductive age, defined as age between 15-44 years [3].

This is the first edition of the Future Leaders Communiqué to discuss an obstetric case of maternal death. We are fortunate in Australia to have a very safe system for obstetrics with a very low rate of 8.5 deaths per 100,000 women giving birth [4]. While the figure at a population level is low, it is devastating for the patients who comprise the 281 maternal deaths and their families. The most common cause of maternal mortality in Australia has been non-obstetric haemorrhage.

Diagnoses often occur over a period rather than at a single point of time, and so there are multiple opportunities to make a correct or timely diagnosis [5]. All aspects of the diagnostic process are vulnerable to error. These include: the patient-physician encounter, performance and interpretation of diagnostic tests, follow-up and tracking of diagnostic information over time, and referral-specific issues. Studies of diagnostic error often reveal a number of root causes in each case. Causes may include cognitive biases, such as failure to synthesis the available evidence correctly [6].

It has been said in medicine, 'when you hear hoof beats, think of horses not zebras' (attributed to Dr Theodore Woodward, physician 1914-2005). While this is true in most cases, we as clinicians need to be aware of these rare 'zebra' diagnoses, and be cognisant of them in our differential diagnoses, especially if they have the potential to be fatal.

CONTENTS

2. Guest Editorial
4. Editorial
5. **Case:** Rare But Catastrophic
8. **Commentary #1** Other Than Occam's Razor
11. **Commentary #2** Splenic Artery Aneurysm Rupture in Pregnancy
13. Further Reading
14. Comments From Our Peers

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FEEDBACK

The editorial team is keen to receive feedback about this communication especially in relation to changes in practice. Please contact us at: **flc@thecommuniques.com**

Guest Editorial (Continued)

The case presented in this edition highlights that education is needed for rare but potentially catastrophic conditions in pregnancy. It is important to think of non-obstetric origins of pain in the pregnant population, in particular surgical causes.

The combination of severe abdominal pain in pregnancy and requiring narcotic analgesia, must alert the clinician to the possibility of ruptured splenic artery aneurysm.

The incidence of rupture of a splenic artery aneurysm is more common in pregnancy. Statistics from the National Coronial Information System database reveal that from 2000 to 2016 there have been eight deaths of pregnant women in Australia from ruptured splenic artery aneurysm. Ignorance of the condition is no longer an excuse, and we must move from a position of an undifferentiated and undiagnosed patient, to a considered possibility of ruptured splenic artery aneurysm that requires investigation and exclusion with a CT angiogram, as deemed appropriate by a consultant and radiologist.

To draw a parallel – we are generally all aware of the potential of a ruptured ectopic being fatal in a pregnant patient; we should be aware of a ruptured splenic artery aneurysm being likewise.

In 2018, Dr Rana Awdish published her memoir, 'In shock: How nearly dying made me a better doctor', recounting her life-threatening non-obstetric haemorrhage at eight months gestation [7]. Rana had a ruptured benign hepatic adenoma that was not initially identified. Whilst she survived her unborn child died.

With education, training, and good processes for escalation of review and care, we can become mindful of rare but potentially catastrophic conditions, to make diagnoses that are timely and accurate, and prevent harm in the setting of missed, delayed or wrong diagnoses.

Editorial

Joseph E Ibrahim and Nicola Cunningham

Welcome to our fourth cohort of junior medical staff for the Future Leaders Communiqué. Our guest editor is Violet Kieu who has worked incredibly hard to complete this edition in a very short space of time. Interestingly, in the course of finalising her editorial and reflecting on learning and sharing experiences as doctors, she wrote to us about her time as an intern in the emergency department at St Vincent's Hospital Melbourne, recalling:

> *'I had not done an arterial puncture before and, asked the ED consultant for help. More than helping, she taught me, without a hint of annoyance at my request. Whilst this should be the norm, stress, busyness, conflicting priorities and a million other pressures sometimes make it not the case in medicine. Dr Nicola Cunningham might not remember being that consultant, but her kindness definitely stuck in my head - and when I saw her involvement in the Communiqués, I wanted to be involved in the discussion to help other doctors in some way, as she helped me.'*

Since then, Violet has worked in paediatric and general surgery, before finding her path to obstetrics and gynaecology, and is planning to undertake a Fellowship in Reproductive Endocrinology and Infertility at the Royal Women's Hospital, Melbourne. Alongside her clinical work, Violet has been heavily involved in cross-disciplinary teaching sessions and has published in national and international peer-reviewed journals. In 2018 she was the recipient of an Outstanding Trainee Presentation award. Violet personifies the view that medicine is about learning and sharing, regardless of one's level of expertise. Her work on this edition of the Future Leaders Communiqué is an important example of how we can use the knowledge and experiences of others and share the lessons learned to improve patient care.

In this edition, Violet presents a case of maternal death arising from a diagnostic error. She draws on the expertise of Dr Kiran Kalian a Consultant Obstetrician and Gynaecologist at Eastern Health, who offers valuable insights into the clinical features of ruptured splenic artery aneurysm. Dr Geoffrey McCallum, Director of Gynaecology, Eastern Health contributes a second commentary to this edition, with a thought-provoking piece on problem-solving in medicine, that every junior doctor should read. Together the case summary and expert commentaries describe the complexities around diagnostic and escalation processes, and encourage us to reflect on what we could do to improve those processes to prevent similar cases from occurring in the future.

On a final note, this edition marks the beginning of two very exciting changes for us. The first is the addition of Dr Brendan Morrissey to our editorial team. Brendan is an Emergency Physician at St Vincent's Hospital Melbourne and a prevocational training supervisor with a passion for medical education. He will be supporting the guest editors throughout their production cycle, so that they are able to make the most of the opportunities to learn and share that the Future Leaders Communiqué offers. The second change is that The Communiqués are now available via Twitter. Follow @TheCommuniques for regular updates and access to our latest editions.

Rare But Catastrophic

Case Number 01/2015 SA
Case Précis Author **Dr Violet Kieu** MBBS, BMedSc, DipSurgAnat, DRANZCOG, MRMed (Excellence)

i. Clinical Summary

Mrs MP was a 25 year old woman who was 23 weeks pregnant with her first pregnancy when she experienced a sudden onset of severe left-sided upper abdominal pain and collapsed at a shopping complex. She described light headedness, blurred vision and ringing in the ears at the time and appeared to lose consciousness with the pain.

She was brought by ambulance to a specialist public women's hospital at 13:52 hours on a Saturday. A midwife examined her in the Women's Assessment Service and found both her and the fetal observations were within normal limits. At 14:45 a resident medical officer (RMO), Dr L reviewed Mrs MP and recorded the history of her presentation, with an assessment noting abdominal pain, possibly renal colic.

Dr C, an obstetrics registrar then performed a bedside ultrasound that was normal. At 15:30 Mrs MP was provided with 1g paracetamol and 5mg oxycodone for pain relief. At 16:45 her pain level was recorded as 4/10 (i.e. moderate pain). Dr C made a plan to await the results of biochemistry testing, to possibly admit Mrs MP for analgesia, and for an ultrasound scan to be considered if the pain did not settle.

'Ms M noted that the abdominal pain was stabbing and associated with 'shoulder tip pain' and requested a medical review.'

At 17:20 Dr C handed over to Dr R, a senior obstetrics registrar, who arranged a hospital admission for Mrs MP and requested a formal abdominal ultrasound be carried out in the morning. Dr R noted a differential diagnosis of *'query renal colic versus pyelonephritis'*, as well as *'??S (splenic) cause'*. Blood results demonstrated that Mrs MP's haemoglobin and platelets were slightly low.

At 18:05, her observations were unremarkable, with a pain score of 4-to-6/10. She was given a further 10mg of oxycodone at 20:15.

At 03:10 the next morning, Mrs MP had severe abdominal pain with a score of 10/10. She was vomiting and unable to ambulate. She was seen by midwife Ms M and given another 10mg of oxycodone and 1g paracetamol. Ms M noted that the abdominal pain was stabbing and associated with 'shoulder tip pain' and requested a medical review. Dr MS, another RMO, saw Mrs MP at 03:45. Dr MS elicited left upper quadrant tenderness without guarding or rigidity, and decided to await the booked ultrasound in the morning. Dr MS documented differential diagnoses of *'? renal colic'* and *'? gallstones'*, A further 10mg of oxycodone was given at 07:25.

Dr JS, an obstetrics registrar, reviewed Mrs MP in the morning at 09:15, when she had a pain score of 6/10. Dr JS recorded left upper quadrant and epigastric pain with no guarding, rebound or peritonism.

Dr JS noted that Mrs MP had *'shoulder pain'*, thought to have occurred when her husband had *'wrenched'* her shoulder during her initial collapse at the shopping centre. Dr JS also documented differential diagnoses of *'? gallstones'* and *'? renal colic'*.

At 10:45 Mrs MP's husband notified nursing staff that she was faint and clammy. Dr JS was called and on entering the room found Mrs MP unconscious on the bed. She was able to be roused and complained of left upper quadrant pain that was *'worse than ever before'*. A code zero (obstetric emergency) was called and the obstetric consultant Dr MT was contacted. On his arrival, Dr MT called a code blue (medical emergency) and arranged urgent surgical intervention for Mrs MP. An off duty general surgeon, Dr W, was telephoned and two anaesthetists were summoned. In the operating theatre, Mrs MP experienced a cardiac arrest after induction with general anaesthesia. Resuscitative measures including external cardiac compressions continued while Dr W proceeded with the surgery. Mrs MP had lost a lot of blood intra-abdominally, but Dr W was unable to identify the specific source of haemorrhage. Resuscitation attempts were unsuccessful and the surgery was ceased.

ii. Pathology

The source of bleeding was identified at Mrs MP's autopsy. The pathologist established the cause of death as a ruptured splenic artery aneurysm. Mrs MP's baby also died.

iii. Investigation

The focus of the coroner's investigation was why a definitive diagnosis was not made prior to Mrs MP's fatal collapse and, could her death have been preventable. Aspects considered by the coroner during the investigation was that of previous cases of fatal ruptured splenic artery aneurysm in pregnancy, including a case at the same tertiary teaching hospital two years earlier of Mrs MH, a 42-year-old woman who died at 37 weeks pregnant. Another case from a different state was also reviewed, of Ms MJ a 31-year-old woman who was nearly 32 weeks pregnant with her first pregnancy. Regarding the three cases, the coroner noted the typicality of Mrs MP's presentation, specifically that of the staged course of the pathology of initial bleed contained in the lesser sac of the spleen, then a period of relative haemodynamic stability, then a final catastrophic intra-abdominal haemorrhage.

At inquest, the coroner explored the medical practitioners' knowledge of the condition of ruptured splenic artery aneurysm and the role of a radiological diagnosis. Four of the five junior medical staff involved in Mrs MP's care gave oral evidence at the inquest. Their level of knowledge of splenic artery aneurysm as a possible differential was described by the coroner as *'very limited'*, *'limited'*, *'virtually nil'* and *'imperfect'*.

Diagnostic measures, such as a formal upper abdominal ultrasound were never performed. The coroner heard from a radiology expert that the ultrasound would have served as an *'excludogram'*.

That it would have ruled out a suspected kidney source, and probably would have found free fluid or blood, which may have led to an escalation of imaging to CT angiogram, as the gold standard for aneurysmal diagnosis, if requested by a consultant.

Whilst Ms M documented *'shoulder tip pain'*, Dr MS denied being told this information at the time of review of the patient. The significance of shoulder tip pain was discussed at the inquest with regards to potentially being Kehr's sign, reflecting irritation of the diaphragm due to intra-abdominal haemorrhage, as distinct from local musculoskeletal injury.

Two independent obstetricians provided expert advice. The first obstetrician stated that despite its rarity, doctors should know of the condition of ruptured splenic artery aneurysm, as it poses a very high risk of maternal and perinatal mortality. The expert was not critical that none of the practitioners made the diagnosis, but critical that a consultant was not asked to review Mrs MP prior to her fatal collapse.

The coroner did not agree, stating more fault was with those responsible for the education and professional development of those practitioners.

That same expert also proposed that the hospital should develop a *'statement'* to staff that if a patient presents with left upper abdominal pain, the possibility of splenic artery aneurysm, which can be lethal, needs to be at least considered. With this, the court agreed that it was sensible advice and in accordance with a literature review of cases.

The second obstetrician stated that *'such rarity of low likelihood of ever encountering such a case clinically makes it extremely difficult to say one would make the correct diagnosis, no matter the seniority of clinician.'* The coroner, however, considered it was very difficult to defend such a position in light of two experiences at the same hospital and the findings of a coronial inquest interstate. Both obstetricians were critical of the fact that the registrar who attended Mrs MP at 09:15 did not take observations themselves, and both agreed that a CT angiogram at 23 weeks gestation did not present any significant risk to the pregnant patient.

The hospital provided the coroner with details about the remedial steps already undertaken following the earlier death of Mrs MH. These included the use of MEWS (maternal early warning scores) charts and clinician training regarding the symptoms and diagnosis of shock. The coroner noted, however, that hypovolaemic shock was not always part of an early presentation of ruptured splenic artery aneurysm.

The hospital also ran a PROMPT (practical obstetric multi-professional training) program and had implemented a mortality committee recommendation that senior clinicians are to be notified of all patients admitted to their assessment service.

iv. Coroner's Findings

The coroner found that the cause of death was ruptured splenic artery aneurysm, yet could not say that it was preventable. It was not possible to determine when in time Mrs MP's survival could have been assured had her aneurysm been diagnosed. It was possible, but by no means certain, that a consultant may have been suspicious of the diagnosis and taken the necessary diagnostic and remedial steps prior to Mrs MP's fatal collapse.

'The coroner's recommendations emphasise the need for professional development regarding rare but potentially catastrophic conditions.'

The coroner recommended education and professional development concerning the condition of ruptured splenic artery aneurysm, and immediate referral and supervision by a consultant (obstetric, emergency or surgical) when pregnant patients present with a sudden onset of severe left upper abdominal pain. The coroner endorsed the recommendation in the coroner's finding for Ms MJ that *'intra-abdominal haemorrhage (e.g. ruptured splenic artery aneurysm, ruptured liver) should be considered as part of the differential diagnosis when a pregnant woman presents with severe abdominal pain especially if she requires narcotic analgesia.'*

The coroner further recommended that consultant-level discussion with a radiologist regarding the appropriateness of a CT scan should take place, and that if other differentials are considered more likely, diagnostic measures should be conducted urgently. The coroner also suggested the co-location of maternity services within general medical services.

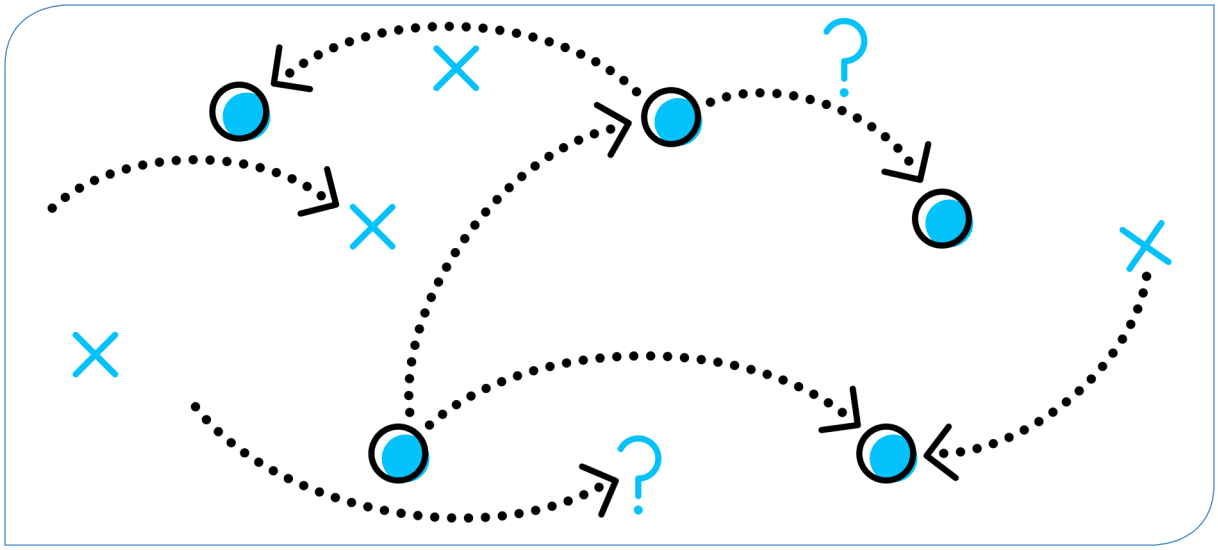
v. Author's Comments

This coroner's case of maternal death due to haemorrhage from splenic artery rupture has many learning points: it underlines the dangers of undifferentiated severe abdominal pain in pregnancy, the role of interpretation of vital signs, escalation to consultants, and also the role of referral and multidisciplinary team involvement of radiology, surgery, anaesthetics and emergency colleagues.

The system problems that contributed to the death included a delay in diagnosis, from lack of education and experience of the condition, as well as a delay in escalation of care to a doctor of consultant level. The coroner's recommendations emphasise the need for professional development regarding rare but potentially catastrophic conditions, with implications for future practice aimed at timely consideration of differentials, early radiological diagnosis, and urgent surgical intervention.

vi. Keywords

Ruptured splenic artery aneurysm, diagnosis, pregnancy, abdominal pain, collapse, escalation of care



Other Than Occam's Razor

Dr Geoffrey McCallum,
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I was flattered to be asked to provide an Expert Commentary on this interesting and ultimately tragic case of a young pregnant woman who died as a result of a ruptured splenic artery aneurysm. On the other hand, I am also somewhat embarrassed at the designation of me as an expert as it does not arise from my personal experience of diagnosis and management of this condition.

My awareness of the condition of ruptured splenic artery aneurysm has its genesis when a young anaesthetist, who had worked with me when I was a registrar at the Queen Victoria Hospital in central Melbourne in the 1980s, passed away from this condition.

Alice (not her real name) was a lovely woman and a very competent doctor who was married to one of our specialist colleagues.

The general circumstances of her case were that she was pregnant, in the third trimester as I recall, when she collapsed at home. Her husband was at work. She called an ambulance herself but when she arrived at the hospital she could not be revived.

As a consequence, although I was not involved in the case, I did carry in my mind the diagnostic possibility whenever I was faced with a sudden collapse, especially of a pregnant woman.

'Death from ruptured splenic artery aneurysm is relatively uncommon, though more common in pregnant women than any other identifiable group.'

The findings of the coronial inquest into the case presented in this edition run to 66 pages. In what follows I propose to very briefly summarise the findings of the coroner and expand upon what I see as the learnings from this case, both specific and general.

Brief summary

Mrs MP was a 25 year old woman who was 23 weeks gestation in her first pregnancy at the time of her death in February 2012.

The cause of her death, which was only determined at autopsy, was a ruptured splenic artery aneurysm.

Mrs MP had arrived at hospital by ambulance having experienced sudden left-sided upper abdominal pain and collapse on the day prior to her death. Upon her arrival in the emergency department, her vital signs were stable.

During her brief admission, she was seen by various levels of junior medical staff but was not seen by a specialist obstetrician until she suddenly deteriorated and was taken to theatre where she died on the operating table.

Background

Death from ruptured splenic artery aneurysm is relatively uncommon, though more common

in pregnant women than any other identifiable group. However, there have only been eight recorded deaths of pregnant women dying from this cause in Australia between 2000 and 2015.

In cases of ruptured splenic artery aneurysm in pregnancy the survival rate for the woman is thought to be around 25% while that of the fetus is only around 5%. So ruptured splenic artery aneurysm is a rare but usually fatal complication of pregnancy.

There are various reasons why the fatality rate is so high. These include: The fact that the presentation is often in two stages. Firstly there is sudden pain, which may be accompanied by collapse, however the vital signs may stabilise as the haemorrhage is often confined

'It does seem ironic that this was the second case within three years in the same hospital and yet the diagnosis was not made in time.'

to the lesser sac, (get out your anatomy book) [1], which exerts a tamponade effect on the bleeding aneurysm, restricting the blood loss.

The second collapse, which is more profound than the first and frequently fatal, occurs when the lesser sac ruptures and the aneurysm then bleeds freely into the peritoneal cavity.

In the case of both these women, Mrs MP and Mrs MH, the initial stability of the vital signs probably contributed to a delay in diagnosis and in particular failure to obtain timely imaging, either ultrasound or CT scan, which might have led to the diagnosis being made at a time when operative intervention might have saved the patient's life, and also the life of the unborn baby.

How can this outcome be prevented in the future?

Part of the answer is consciousness raising through education. It does seem ironic that this was the second case within three years in the same hospital and yet the diagnosis was not made in time.

Escalation to more senior clinicians was deficient in this case, which is not to imply that such escalation would necessarily have resulted in a different outcome, though it may have.

Prominent in medical education, at least when I was a student, was the concept of Occam's Razor. This is a simple decision-making algorithm based on the idea that common things occur commonly and the most likely diagnosis in any clinical situation is the simplest hypothesis which explains all, or nearly all, the findings. However, this approach can unfortunately be misleading in cases like ruptured splenic artery aneurysm for, although common things occur commonly, uncommon things also do occur.

I am reminded of a recent case where a pregnant woman attended an emergency department on several occasions with right sided upper abdominal pain. Ultrasound imaging revealed that she had gallstones. In this case, Occam's Razor put the two things together and the conclusion was that the gallstones were causing the pain.

In due course she was admitted at 34 weeks gestation with worsening pain. Unfortunately, obstetric doctors did not become involved in her care until several days later when she became acutely unwell and a laparotomy was performed for what imaging suggested was a ruptured bowel presumed to be due to the gallbladder or possibly the appendix. However, at laparotomy a ruptured stage 4 carcinoma of the colon at the hepatic flexure was discovered. The obstetrician performed a very rapid caesarean section but unfortunately the baby was unable to be revived.

The take home messages

Of course we should all learn to recognise and respond to the symptom pattern or presentation of ruptured splenic artery aneurysm. The coroner in his recommendations focused on education about this specific issue. However, this problem is fortunately quite rare, and you may well never see one so I think the recommendations need to be broadened to be more widely useful.

Occam's Razor is a useful algorithm, but it is not perfect and does not always point you in the direction of the correct diagnosis. It is a useful tool but do not become a slave to it and always consider other diagnostic possibilities.

Unusual conditions and atypical presentations may require timely imaging to achieve a diagnosis Escalate unusual cases to the top, which may or may not solve the

clinical dilemma, but the more wise heads on the case the better.

Unusual cases, especially those with dramatic or tragic outcomes, should be presented and we all need to learn from them. But not just the specifics of the case, but how to take a broad, objective diagnosis-based approach to unusual cases even if it involves getting senior colleagues and radiographers out of bed in the middle of the night.

My final point is a general one. In emergency departments across the country there is a lot of pressure to get patients processed and out of the department quickly. This leads to a tendency to see pain as the problem and narcotic analgesia and discharge as the solution, without a diagnosis being made. As clinicians dedicated to diagnosis-based medical management, we need to actively resist this trend.

A simple rule is this. If the patient has collapsed or, is in so much pain that narcotic analgesics are required, then a timely diagnosis as to the cause of the symptoms needs to be made. This usually means imaging and/or laparoscopy, and escalation to a senior clinician, often at an unsociable hour.

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Splenic Artery Aneurysm Rupture in Pregnancy

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Making a diagnosis in clinical medicine is a key aspect of health care (1). Diagnoses may become obvious when they are commonly encountered. Non-lethal conditions tend to lend time to the clinician to establish the diagnosis. When diagnoses are infrequently encountered or difficult to make, a delay in a diagnosis of a potentially lethal condition can lead to a catastrophic health outcome such as death.

The World Health Organisation (WHO) estimates an individual risk of a death from a medical accident whilst receiving healthcare is 1 in 300. As a comparison the individuals' risk of death as a result of flying in an aeroplane is 1 in 3 million (2).

Inaccurate or delayed diagnosis is one of the most common causes of patient harm and affects millions of patients worldwide (1). Approximately 5% of adults suffer diagnostic errors in developed countries with an estimated 50 % of these errors causing severe harm (3,4). Medical record reviews demonstrate that diagnostic errors account for 6-17% of all harmful events in hospital (1).

Several decades of research in post-mortem examinations have consistently shown that diagnostic errors contribute to about 10 % of patient deaths (5). Autopsy remains an important modality in detecting diagnostic errors and assist in dictating further learning and risk management issues for future prevention of error(s).

The coroner's findings in the case summary highlights four potential areas contributing to the delay in diagnosis:

1. Substandard care by health care organisations and health professionals that failed to learn from similar past experiences. That is, a missed opportunity of open loop constructive feedback to create opportunity to learn and improve on the diagnostic processes following two previous deaths from Splenic Artery Aneurysm rupture (one occurring in the same institution).
2. Failure to involve senior clinicians early in the diagnostic process.
3. Poor team work and communication that should have involved multidisciplinary specialties.
4. Failure to have fully appreciated the nature and characteristics of the patient's presenting symptoms.

Splenic artery aneurysms (SAA) are the commonest visceral vessel aneurysms and occur most commonly in women. Over 80 % of these aneurysms occur in women over the age of 50 years.

The 6th decade is a particularly vulnerable age. About one third of these women have other intra-abdominal aneurysms (6).

Pregnancy poses a specific high risk to these women that have asymptomatic SAA. The aetiology of the aneurysm is unclear. Several theories related to atherosclerosis, collagen vascular disease, arterial media wall fibrodysplasia, portal hypertension and autoimmune disease have been put forward. Being four-fold more common in women than in men, the aneurysm is likely to rupture secondary to increased blood flow of pregnancy with the associated hormonal changes (estrogen, progesterone and relaxin) and vessel wall damage. Collectively these factors cause further damage to the tunica media of the splenic artery resulting in intra-abdominal haemorrhage (6,7).

Whilst the true prevalence of SAA in childbearing age was less than 0.1% in a large institutional study, no SAA ruptures were encountered in this six-year follow up study of pregnant women between 15-49 years of age (8). Other studies have reported incidence of rupture as high as 69 % in the third trimester with lower frequency in the first and second trimesters (9).

The important factor to appreciate is that mortality from SAA rupture rises from 25% in the non-pregnant state to 75% in the pregnant state with accompanying fetal mortality (10). It is therefore critical to appreciate the following points about SAA rupture presenting in pregnancy:

1. Patients with symptomatic unruptured SAA present with nausea and vague abdominal discomfort in the mid epigastric or left upper quadrant. Mrs MP was admitted with left upper quadrant pain.

2. Rupture can be either a sudden rupture or 'double rupture phenomena', which is present in 20- 25% of cases (10). The latter is characterized by containment (tamponade) of initial rupture within the lesser sac by either omentum and/or blood clots that block the foramen of Winslow. This is followed by free rupture into the greater sac when the tension within the lesser sac increases. This free rupture can occur 6 – 96 hours later.

3. The delay in the diagnosis of ruptured SAA during pregnancy is attributed to the pursuit of the more common obstetric and non-obstetric emergencies such as placental abruption, uterine rupture, pyelonephritis or amniotic fluid embolism. A multidisciplinary approach should be encouraged when usual common diagnoses are excluded by attending emergency or obstetric staff.

4. Rupture of a SAA is usually characterized by a consistent sharp abdominal pain, either in the epigastrium or more often localized to the left hypochondrial area with associated pain in the tip of the left shoulder (Kehr's sign) (10). This is suggestive of haemoperitoneum irritating the diaphragm. There was documentation of Kehr's sign in Mrs MP's medical records.

5. Ultrasound can be a helpful tool for rapid assessment of acute abdominal bleeding necessitating immediate resuscitative measures irrespective of the differential diagnoses.

In conclusion, it is likely that most people will experience at least one diagnostic error in their lifetime, sometimes with devastating consequences. However, every effort should be made to improve diagnostic processes to reduce or delay diagnostic errors. More than 400 cases of ruptured SAAs have been reported in the international literature, approximately 30% of these described during pregnancy (11). One common central theme emerging from these reports is advocating for a heightened clinical awareness of SAA rupture in pregnancy in the presence of hypervolemia and non-specific abdominal symptoms, particularly involving pain in the left upper quadrant and tip of the left shoulder.

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Comments From Our Peers

"It reminds me of the risks of considering pain primarily as a management issue rather than approaching it as a diagnostic issue."

"While education being highlighted as a solution is valuable, the case also highlights the importance of experience. Reading these unfortunate cases often helps me to stick the diagnosis in the back of my mind."

"Always have a differential diagnosis, even if you are wrong in the end. It helps guide investigations and management."

"Although pain is easily dismissed in the setting of normal vital signs, pain refractory to analgesia and opiates should ring new alarm bells."

"This case reminds me of my lectures with Professor John Murtagh who has an excellent and well published approach to diagnosis in General Practice which seems relevant to this case: https://www.youtube.com/watch?v=-OE4DfSpcX4 (video of Professor John Murtagh explaining his model)."

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