PART 2

Clinical cases

Introduction

Having set the scene with a general discussion of error and medico-legal theory, we now come to the backbone of our book: the case studies. We have chosen 36 cases which are based on actual scenarios but which have been anonymized and altered to preserve confidentiality and to maximize the educational messages of the case. In addition to a medical and legal comment, at various points in the description of a case, we ask direct questions that are designed to engage the reader in the case and to get them to think about how they would respond if they were in that situation. The case studies are rounded off with key learning points.

The medical comment is provided in the section entitled 'Expert Opinion'. In the Legal Comment section, reference is often made to the 'instructed expert'. This instructed expert refers to the expert that the hospital or the family may instruct as part of the litigation process. His or her views may differ from that of the writer of the medical, Expert Opinion. As much as it is a science, medicine is also an art. There is often room for argument over the finer points of a case. But that does not obviate the general conclusions that we draw, or the benefits that can be gained from the reading of our case studies.

They are here to stimulate thought and encourage learning and to help diminish the incidence of errors.

Avoiding Errors in Paediatrics, First Edition. Joseph E. Raine, Kate Williams and Jonathan Bonser.

Case 1 A boy with a limp

Sam, an 11-year-old boy presents to the ED with a limp. He was playing football 2 days earlier but does not recall any injury. He is otherwise well with no history of recent illness. On examination Sam is noted to be obese with a weight of 74 kg. He is apyrexial. He has an obvious limp and Dr Butler, the FY2 in the ED, notes that the movements of the left hip are limited and painful. He does a FBC, CRP and ESR, which are all normal, and orders a pelvic X-ray on which he can see no abnormality. Dr Butler diagnoses a sprained muscle or a transient synovitis and prescribes ibuprofen. He also makes a referral to the paediatric clinic because of Sam's obesity.

Do you agree with the diagnosis? Would you have managed the case differently?

Sam does not attend that appointment, which is 7 weeks later and is referred back to his GP. Sam sees his GP 3 months after the initial visit to the ED because he still has a limp and the pain has got significantly worse. The GP is concerned about the length of time that the limp has lasted for and refers him to the paediatric rapid referral clinic where he is seen the next day.

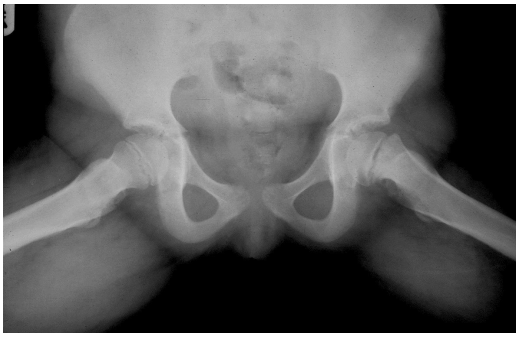
In the paediatric clinic he is apyrexial and is noted to have a limp and a leg that is flexed and externally rotated. There is left hip tenderness and a significantly restricted range of movements. There are no other signs. The paediatrician, who also asks about the obesity, discovers that there is a family history of hypothyroidism and that Sam also has a small goitre and is short with a height of 130 cm which is on the second centile.

What investigations would you perform?

A FBC, CRP, ESR, TFT, TPO antibodies, glucose and an insulin like growth factor 1 (IGF-1) are done and a pelvic X-ray and a frog leg view (see Case Figure 1.1) are obtained.

The results are as follows:

FBC	Normal	Normal
ESR	12 mm/hour	<15 mm/hour
CRP	4 mg/L	<6 mg/L
FT4	8.9 pmol/L	12–22 pmol/L
TSH	62 mU/L	0.5–5.0 mU/L
TPO antibodies	1221 IU/ml	0–34 IU/ml
Glucose	5.2 mmol/L	3.5–5.5 mmol/L
IGF-1	39 nmol/L	18–90 nmol/L



Case Figure 1.1 Frog leg view

The paediatrician asks the radiologist to report the X-rays urgently. The radiologist diagnoses a left sided slipped upper femoral epiphysis (SUFE) which is clear on the pelvic X-ray and frog leg views. The radiologist also comments that the slip could be seen on the initial pelvic X-ray 3 months earlier. However, due to an error the initial X-ray was never reported.

What would you do now?

Sam is referred to the orthopaedic team who see him later that day and operate on him the next day pinning the femoral head to the femoral neck. The paediatrician also diagnoses Hashimoto's (autoimmune) thyroiditis and commences thyroxine.

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Following surgery Sam continues to have hip pain, diminished hip movements and a limp and subsequently requires an arthrodesis (hip fusion).

Sam's mother complains and then sues the hospital, stating that if the diagnosis had been made at the first visit then her son would have not have suffered for so long and would not have required a second operation.

Expert opinion

A limp is a common problem in children and requires an evaluation of the back, hip, knee, ankle and foot. The problem may be orthopaedic, rheumatological, neurological or dermatological. One should also remember that hip pain can be referred to the knee. Though it is very important to rule out an infective condition such as a septic arthritis, other conditions must also be considered especially in a child who is systemically well and apyrexial.

SUFE is the most common hip disorder in adolescence. It occurs in children aged 10–16 years with a mean age of 13 years in boys and 11.5 years in girls. It is commoner in boys (2.5:1), on the left and obesity is a risk factor.

Dr Butler, the FY2, should have told Sam's mother to return to the ED if the pain had not improved within a few days. He should also have known more about SUFE, been aware of the frequency of this disorder in this age group and of the increased likelihood of a SUFE in an obese patient. A FY2 will have little experience in interpreting pelvic X-rays and Dr Butler should have asked an orthopaedic surgeon or radiologist for a second opinion on the X-ray.

In the 10–16 years age group a frog leg (or lateral hip) view is required as some slips are not obvious on the pelvic X-ray. In confirmed cases urgent orthopaedic assessment and treatment are required as even in those with a long history of several months, an acute on chronic slip can occur which can lead to avascular necrosis of the femoral head.

25% of patients also have a contralateral slip and the other hip must therefore be carefully assessed.

A minority of patients with SUFE have an underlying endocrinopathy or metabolic disorder (hypothyroidism, hypogonadism, growth hormone abnormalities, panhypopituitarism or renal osteodystrophy) and if this is suspected then the appropriate investigations should be performed. Obese individuals, such as Sam, should also have their fasting glucose measured. A better history and examination may have led to the diagnosis of hypothyroidism at the initial visit.

Sam's mother is justified in claiming that the diagnosis of a SUFE should have been made following the initial visit to the ED.

Legal comment

The expert comment above states that Sam's mother is justified in claiming that the diagnosis should have been made earlier. An instructed expert is likely to be critical of the actions of the FY2 in ED. Although Dr Butler examined the X-ray he failed to detect the abnormality and did not request a second opinion. The radiologist looking at the X-ray 3 months later commented that the slip was visible on the initial X-ray. Maybe a frog leg or lateral view of the hip should have been taken, as this would have revealed the problem more clearly. Dr Butler also failed to advise Sam's mother to bring him back if there was no improvement. Earlier intervention may not have cured the problem. However, an instructed expert is likely to conclude that earlier intervention would have made a difference. Thus the case will probably be settled. The claim will be worth at least £70,000 and possibly much more depending on the patient's prognosis post arthrodesis.

Key learning points

Specific to the case

1. A limp in a child requires an assessment of the back, hip, knee, ankle and foot.
2. SUFE is the most common hip disorder in adolescence, obesity is a risk factor.
3. A frog leg (or lateral hip) view is also required as a minor slip may not be obvious on the pelvic X-ray.
4. Treatment is urgent as an acute on chronic slip can occur which may lead to avascular necrosis of the femoral head.
5. In a minority of cases of SUFE there is an underlying endocrinological or metabolic abnormality.

General points

1. A sound knowledge of common orthopaedic emergencies is essential in doctors working in the ED.
2. Even in the busy environment of an ED it is essential to obtain a good history and examination in order to reach the correct diagnosis.

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3. Clear instructions should be given to parents on the natural history of their child's condition and at what point they should seek a further medical opinion.
4. A junior doctor should have a low threshold for obtaining a second opinion on a X-ray of a part of the anatomy that they are not familiar with.
5. The hospital should review its procedures for reporting X-rays.

Further reading and references

Thacker MM, Clarke MS (2009) Slipped Capital Femoral Epiphysis. http://emedicine.medscape.com/article/1248422-overview

Tidy C (2008) Slipped Upper Femoral Epiphysis. http://www.patient.co.uk/doctor/Slipped-Upper-Femoral-Epiphysis.htm

Case 2 A fitting infant

Alesha had multiple reviews by the midwife and GP because of repeated episodes of crying and irritability. She fed poorly initially but this had improved. She is the first child of her mother, Sharon, who seems to be at the end of her tether. Sharon is well, not on any medication and does not abuse drugs. The GP, Dr Robson, cannot find any abnormal signs examining the infant and he and the midwife ascribe the problem to 'an over anxious first time mum'.

At the age of 3 months whilst on the way home from visiting grandma, Alesha has a fit and an ambulance is called. She is still fitting on arrival at the hospital. The oxygen saturation is 84% but normalizes following the administration of oxygen. Breathing and circulation are stable. Buccal midazolam, iv lorazepam, rectal paraldehyde and iv phenytoin are required to stop the fit which lasts for a total of 1 hour and 5 minutes. Intravenous ceftraixone is also administered though Alesha's temperature is only 37.1°C. There is no rash, the anterior fontanelle is flat and there is no obvious neck stiffness. A FBC, CRP, U and E's, bone chemistry and LFTs are normal. A blood culture is performed and a urine dipstick is normal. A cranial CT scan is also normal. A provisional diagnosis of epilepsy is made.

What is your opinion of the emergency management?

Alesha continues to have fits overnight which require additional iv lorazepam and rectal paraldehyde. She has 6 fits in total lasting between 5 and 20 minutes. Alesha remains apyrexial but is noted to be irritable.

On the following morning on the consultant ward round it is noted that the blood glucose has never been measured. A bedside reading is immediately done and the blood glucose is found to be 1.3 mmol/L (this is confirmed by the laboratory measurement which is 1.1 mmol/L). A more detailed history reveals that the irritability and fits usually preceded a feed. Detailed endocrinological and metabolic blood and urine tests are done during an episode of hypoglycaemia. Alesha goes on to have pre-feed blood glucose readings which range between 1.5 and 3.6 mmol/L. Higher volume feeds are given 3 hourly, rather than 4 hourly, with nasogastric top ups and the pre-feed glucose levels rise to $\geq$ 2.6 mmol/L and the fits stop.

What is the likeliest diagnosis?

The insulin level is found to be inappropriately high at a time when the blood glucose was low and a diagnosis of persistent hyperinsulinaemic hypoglycaemia of infancy (PHHI) is made. An EEG shows minor abnormalities only and a MRI is normal.

Alesha is referred to a tertiary unit and a number of drugs such as diazoxide and octreotide are tried. However, these fail to abolish the hypoglycaemia and a 95% pancreatectomy is performed. Alesha remains hypoglycaemic and requires a further operation where a further 4% of her pancreas is removed.

What long-term sequelae are likely to develop following surgery?

Subsequently, Alesha has normal blood glucose levels but goes on to develop type 1 diabetes and malabsorption requiring pancreatic supplements.

At 5 years of age she is diagnosed as having moderate learning difficulties and her mother Sharon sues Dr Robson and the hospital because of the delay in the diagnosis which she feels has led to the learning difficulties.

Expert opinion

Sharon had repeated visits to her midwife and GP, Dr Robson, and regrettably her concerns were not taken sufficiently seriously. Neither Dr Robson, the midwife nor the junior medical staff took a sufficiently detailed

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history to establish the link between feeding and the excessive crying, irritability and fits.

Measuring the blood glucose in a fitting child should be standard practice. After basic resuscitation relating to the airway, breathing and circulation (ABC) the mnemonic DEFG is often used which stands for Don't Ever Forget Glucose. There is little point in performing sophisticated tests such as a CT scan, yet not doing a very basic bedside test which takes 30 seconds such as a blood glucose measurement.

PHHI is the commonest cause of hypoglycaemia in infancy. It is associated in some studies with learning difficulties and nonhypoglycaemic fits which are often attributed to brain damage from early hypoglycaemic events and seizures, and these may have led to Alesha's learning difficulties. However, other studies have shown normal development. There is also some data to suggest that infants diagnosed and treated early have a better neuro-developmental outcome. There are no comprehensive long-term studies of neuro-developmental outcomes in patients with PHHI.

Legal comment

The Expert Opinion above criticizes the actions of the hospital. An expert is likely to conclude that the blood glucose should have been tested earlier. However, it is by no means clear that earlier intervention would have made much difference to the outcome. The lawyer will ask his instructed causation expert to comment on whether, on the balance of probabilities, earlier treatment would have:

1. saved a greater portion of Alesha's pancreas;
2. prevented the onset of diabetes;
3. prevented the neurological problems.

These causation issues will determine whether the case will be pursued by the parents. If the instructed experts conclude that treatment would have prevented these outcomes, then the case may be worth more than a million pounds, depending on Alesha's ability to look after herself in the future and her prospects on the job market. But if there is significant doubt that a better outcome would have been achieved, then the case may be dropped or settled for a modest sum.

The lawyers will also wish to look at the actions of Dr Robson and the midwife (if she belonged to a different Trust). If their actions were inappropriate, then the midwife's Trust and the GP (through his MDO) should contribute to any settlement.

Key learning points

Specific to the case

1. In any fitting child it is mandatory to perform a blood glucose measurement to rule out hypoglycaemia as the cause of the fit.
2. Beyond the neonatal period severe sepsis (e.g. Gram negative sepsis or malaria), drugs (e.g. alcohol), endocrinological disorders (e.g. hyperinsulinaemia, ketotic hypoglycaemia, adrenal insufficiency), liver dysfunction and inborn errors of metabolism (e.g. galactosaemia, maple syrup urine disease) are the commonest causes of hypoglycaemia.
3. PHHI is the commonest cause of hypoglycaemia in infancy.

General points

1. It is very important to take a detailed history and to listen carefully to the parent's concerns. A good history is essential in making a diagnosis and in at least 60% of cases leads to the diagnosis.

Further reading and references

Gillespie RS, Ponder S (2008) Persistent Hyperinsulinaemic Hypoglycaemia of Infancy. http://emedicine.medscape.com/article/923538-overview

Hampton JR, Harrison MJG, Mitchell JRA *et al.* (1975) Relative Contribution of History Taking, Physical Examination and Laboratory Investigation to Diagnosis and Management of Medical Outpatients. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1673456/pdf/brmedj01449-0038.pdf

Hoffman RP (2009) Hypoglycaemia. http://emedicine.medscape.com/article/921936-overview

Markert RJ, Haist SA, Hillson SD *et al.* (2004) Comparative Value of Clinical Information in Making a Diagnosis. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1395780/

Case 3 A persistent fever

Arun, a 4-year-old boy, presents to the ED with a fever, coryza and an earache. On examination he is found to have a temperature of 39.1°C, an erythematous throat and pink ear drums. A diagnosis of an upper respiratory tract infection is made by the FY2 doctor. Arun's mother is told that the infection is probably viral and is asked to return if Arun does not improve with analgesia and antipyretics. Two days later Arun represents to ED and this time is seen by a different FY2 doctor. The temperature has persisted and is 39.2°C and Arun is still complaining of ear ache and is now also lethargic and anorexic. His mother also feels that Arun cannot hear properly in his right ear. There is no rash.

Which other symptoms and signs would it be important to document?

There is no documentation regarding symptoms and signs such as a headache, irritability, photophobia or neck stiffness in this or the previous attendance. The FY2 makes the same diagnosis but this time prescribes amoxicillin and Arun is discharged.

He returns 2 days later in the evening as he has deteriorated and is now also complaining of a headache and has vomited twice. This time he is referred to the paediatric team. He still has a temperature and an ear ache. He has no photophobia. The paediatric ST1 also documents that Arun has not been immunized. On examination, his temperature is 39.7°C and there is no rash. Arun's throat is slightly erythematous but with no pus or tonsillar enlargement. His ears appear normal. He can extend his neck fully and can also flex his neck but is unable to get his chin to touch his chest. The registrar reviews Arun, elicits the same signs, and is unsure if the limited neck flexion is abnormal.

Is the neck flexion within normal limits?

A FBC, CRP, U and E's, bone chemistry, LFTs, blood culture and meningococcal PCR are performed and urine is collected for microscopy and culture. The registrar wants to do a LP but Arun's mother is reluctant for him 'to have a needle put in his back'.

What would you do now?

The registrar decides to admit Arun and to administer high dose iv ceftriaxone. The FBC has a raised WBC of 22.4×10^9/L (normal 4–11 $\times 10^9$/L), the CRP is also elevated at 143 mg/L (normal<6 mg/L) and the U and E's, bone chemistry, LFTs and urine dipstick are normal. The following morning Arun has a 20-minute generalized seizure which is terminated with iv lorazepam. A cranial CT scan is done which is normal and later that afternoon a LP is performed. The CSF has a WBC count of 684×10^6/L (normal$<5 \times 10^6$/L) of which 60% are polymorphs, a protein of 1.6 g/L (normal 0.2–0.4 g/L) and a glucose of 1.9 mmol/L (normal 2.8–4.4 mmol/L). Gram stain is negative but the rapid antigen screen is positive for *Haemophilus influenzae* and a diagnosis of *H. influenzae* meningitis is made.

Does this result influence your management plan?

Intravenous dexamethasone is then prescribed.

Arun subsequently has further fits and is commenced on phenytoin. He has a 7 day course of iv ceftriaxone and goes on to develop mild learning difficulties, epilepsy and right-sided hearing loss.

Arun's mother makes a complaint and later sues the hospital stating that the diagnosis and treatment where inappropriately delayed.

Expert opinion

The absence of comprehensive documentation during the first two attendances makes it difficult to determine if the diagnosis and treatment were appropriate.

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Meningitis is such a serious condition that it should always be in the back of one's mind when seeing a sick, febrile child and it is important in such cases to document the presence or absence of features associated with meningitis. It is not unusual for meningitis to be preceded by upper respiratory or gastrointestinal symptoms and it is possible that in the early stages of this case there was no headache, photophobia or neck stiffness. However, this should have been documented. The absence of immunizations in Arun would also have raised the risk of him having a serious bacterial infection and this fact should also have been documented at the first presentation. The FY2 doctors should have obtained a more senior ED or paediatric opinion on this child and this would be routine procedure in many EDs.

Neck stiffness can be difficult to assess in children under 1 year of age. However, over 1 year of age, and certainly at 4 years of age, the presence of neck stiffness should be clearly elicitable. When the meninges are inflamed flexing the neck in particular stretches the meninges and causes pain. A 4-year-old should be able to place his chin on his chest and his inability to do so denotes a degree of neck stiffness compatible with meningitis. Partial treatment of meningitis, as in this case, is quite common and can modify the signs and the investigation results and should lower the threshold for suspecting meningitis and performing a LP. Following the refusal of Arun's mother to allow him to have a LP the registrar should have discussed the case with the consultant. A review of Arun by the consultant may have persuaded his mother to allow the LP.

Dexamethasone has been shown to decrease the risk of neurological sequelae and deafness in children with some types of bacterial meningitis, particularly *Haemophilus influenzae*. Dexamethasone should be administered just before or concomitantly with the first dose of antibiotic. However, the role of dexamethasone in partially treated meningitis has not been evaluated. It is therefore not possible to say whether its earlier use, following an immediate LP upon admission to the ward, would have made a difference to Arun. Nevertheless, there would be a case for administering it on purely clinical grounds, given the likely diagnosis of meningitis, immediately prior to the iv ceftriaxone as it has few adverse effects. Administering dexamethasone following the LP was a reasonable course of action even though the efficacy of the delayed administration of this drug is unknown.

It is possible that the deafness may have been unavoidable even with early treatment, but the accompanying epilepsy and mild learning difficulties may have been avoided with an earlier diagnosis and treatment.

Legal comment

An important factor in this case was Arun's mother's refusal to let him undergo a lumbar puncture: she refused to give her consent to the procedure. The Key Learning Points below state that, in such cases, a consultant should be informed. It may be argued that the clinicians could have performed the LP anyway, on the basis that the procedure was in the best interests of the child. However, this would have been very difficult in practice. It is always preferable to try to persuade parents of the need for a procedure or course of treatment, rather than to act unilaterally, and the consultant may have persuaded Arun's mother of the need for the LP. Ignoring the wishes of a parent lays clinicians open to criticism and to a potential complaint.

There are failings in the treatment provided to Arun and the lack of documentation will make it difficult for the hospital to defend the standard of care. However, the family may have difficulty in establishing that earlier treatment would have altered the outcome. The Expert Opinion comments that deafness may have been unavoidable. But if an instructed expert concludes that the epilepsy and mild learning difficulties would probably have been avoided with earlier treatment, then the case could be worth several hundred thousand pounds and perhaps even more. This would depend on Arun's ability to look after himself in the future and his prospects on the job market.

Key learning points

Specific to the case

1. Meningitis should always be considered in a febrile, sick child as it is a serious but treatable condition.
2. Symptoms such as a headache and vomiting and signs such as neck stiffness and a rash should be sought and documented.
3. Prior treatment with antibiotics is not uncommon. It can modify the signs of meningitis due to partial treatment and should lower the threshold for suspecting this condition.
4. Dexamethasone, in addition to antibiotics, is part of the treatment of bacterial meningitis in children.

General points

1. Comprehensive documentation is very important.

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2. ED departments should have clear protocols stating when a case should be discussed with a senior ED colleague and when a patient should be referred for a specialist opinion.
3. If a parent objects to an investigation that is considered necessary and that could modify treatment then the case should be discussed with the consultant. The consultant may need to see the patient themselves and occasionally child protection proceedings need to be instituted. It is advisable for paediatric departments to have a list of conditions that a junior doctor should discuss with their consultant.

Further reading and references

Meningitis Research Foundation (2011) Useful source of information on meningitis and septicaemia for health professionals and the public. http://www.meningitis.org

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