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SSC 5c Part 1: Anaesthetics

1) Compare anaesthetic service provision in the UK and the US.

I encountered many differences between the anaesthetic services in the US and the UK: from the staff training aspects to the perioperative practicalities. One overarching difference between the systems is the constant presence of medicolegal consideration, which permeates every aspect of healthcare provision. Whilst in the UK there is an emphasis on the importance of documentation and consent, the medicolegal aspect does not occupy such a place at the forefront of care in the way that it appears to in the States. One resident with whom I spoke, had previously practiced in the UK and discussed with me the impact of practicing defensive medicine. Although, despite this being discussed I did not notice any compromise in patient care as a result of this, during my rotation. It was however, clear that patients are much more likely to lodge a legal complaint against providers, which I think only serves to breakdown trust between the provider and the patient.

Undergraduate and postgraduate training are considerably different between the two countries. Whilst the U.S requires predmed years of basic science, which is only in part accounted for by the UK A-level system, their undergraduate and postgraduate clinical education is much shorter. US graduates applying for positions in anesthesia are expected to complete 1 year of internship followed by 3 residency years, in addition to 2 undergraduate years clinical training, before graduating to the equivalent level of a UK consultant. In addition to a supplementary undergraduate clinical year, UK graduates must complete at least 9 years of postgraduate training (including 2 foundation years of general medicine) before being eligible to apply for consultant positions.

This may be due in part, to the fact that the UK anaesthetist's role has less overlap with other healthcare specialties compared to the US. Anaesthetists are required for nearly all in hospital intubations in the UK, whereas in the US: highly trained nurse anaesthetists and ER staff are also able to perform this task. In addition, US residents are offered the chance to extend their training by completing fellowships in particular subspecialties, for example: obstetric anaesthesia, whereas UK trainees have long blocks of subspecialty anaesthesia integrated into their training as standard.

With regards to the peri-operative period there are many similarities: patients undergo a second brief preoperative assessment on the morning of surgery and the questions asked to determine anaesthetic risk and airway grading are by and large the same. Interestingly, however, the surgeons are not required to see the patient on the day of the surgery.

In the US system there are no induction rooms and the patient is anaesthetised on the operating table. This has pros and cons compared to the UK system: As there is no need to transfer patients this reduces the induction time and the risks associated with transfer. However it could potentially lead to increased anxiety on the part of the patient, both from the operating room environment and from the traffic of people preparing the room. In addition: this requires an anaesthetic trolley to be kept in theatres, which contains the anaesthetic drugs. Whilst this is useful: as drugs are immediately on hand to the anaesthetist intraoperatively, space on this trolley is not adequate to contain all the supplies that are able to kept in the UK anaesthetic room. Furthermore, the turnover is much higher in the UK as a result of the system running in parallel.

US anesthesiologists operate much more independently than UK anaesthetists. They are expected to set up their areas and anaesthetise patients alone, as there is no ODP position. This creates new challenges to the induction process and requires different techniques to create adequate mouth opening One such example is the scissor technique, which involves using finger and thumb, placed on the upper and lower molars, to lever the mouth open for blade positioning. I feel that this is a good skill set to have, although from a patient safety aspect, I believe that having an ODP is preferable.

The WHO checklist is completed in both sites, and the extubation and post-operative care is very similar between the two countries.

2) Discuss how child physiology affects anaesthesia.

Children are not small adults, physiologically there are important differences not only between paediatric and adult patients but also between the different paediatric categories of: neonates, infants, children and adolescents. Physiologically, paediatric patients become less different from adults as their age increases.

The younger the child, the larger the head and tongue, relative to the body. The occiput is also more prominent and the neck shorter. In addition, the larynx is higher and more anterior at approximately C3-C4 level, and the longer, stiffer epiglottis flops posteriorly. This affects airway management such that the head should be in neutral position rather than 'sniffing the morning air' position, to aid ventilation and intubation. Caution must be taken during intubation as, in children, the airway is narrowest at the cricoid cartilage and funnel shaped; Thus, trauma resulting in oedema can narrow an infants airway by up to 60%. Special consideration as to the appropriateness of a cuffed or uncuffed tube, depending on the child's age and nature of the procedure should also be given for the same reason.

In terms of ventilation: the closing volume is greater than the functional residual capacity until approx. 8 years of age. This leads to an increased tendency for airway closure and atelectasis at end expiration, which decreases oxygenation and increases the work of breathing. Children use nose breathing in order to provide positive end expiratory pressure (PEEP) to combat this derecruitment. In an intubated child, PEEP and intermittent positive pressure ventilation are often needed. In addition: ventilation in children is primarily diaphragmatic, so particular attention must be given to pre-oxygenation in which poor bag mask ventilation can lead to increased stomach gas with associated splinting of the diaphragm.

A neonate's cardiac output is rate-dependent, due to a less contractile myocardium and less compliant ventricles. As vagal parasympathetic tone is more dominant, neonates are more prone to bradycardias and, consequently, bradycardia-associated hypoxia. Alterations in pressure, hypoxia and acidosis can lead to reversal of ductus arteriosus and foramen ovale closure in neonates and a return to the transitional circulation.

Dehydration is poorly tolerated in younger children due to increased insensible losses through a relatively large body surface area, and a larger proportion of extra-cellular fluid. Furthermore, tubular function is immature until 8 months and renal blood flow and GFR lower in the first 2 years, leading to an increased tendency to accumulate sodium.

In addition to the insensible fluid losses, a large body surface area also contributes to difficulties with temperature control in neonates and infants. Adding to this problem are: poorly developed vasoconstricting and shivering mechanisms and only small amounts of subcutaneous fat. Brown fat metabolism, required for non-shivering thermogenesis, requires large quantities of oxygen. Low body temperature can lead to a constellation of anaesthetic risks, such as: greater tendency towards respiratory depression and acidosis, and decreased platelet function. Increased duration of drug action and increased risk of infection are also factors associated with low body temperature.

Consequently, ambient temperature must be carefully controlled and core temperature regularly monitored in children intraoperatively.

The blood brain barrier is poorly formed in babies, which can also contribute to a prolonged duration of action of certain drugs, such as: opiods and barbituates, that are capable of crossing it. Friable cerebral vessels in preterm infants are also prone to haemorrhage. Therefore, fluctuations in blood pressure and cerebral blood flow must be minimised, as should the risk of hypoxia, hypercapnia and hypernatraemia.

Metabollically, opiods and barbituates have a longer duration of action in children due to immature hepatic enzyme function. Hypoglycaemia is also common in the stressed neonate, such that glucose levels should be monitored intraoperatively. Vitamin K dependent clotting factors and platelet function are also immature in the first few months of life: Whilst newborns are given vitamin K at birth to prevent haemorrhagic disease of the newborn, it is generally recommended to transfuse when 15% of circulating blood volume has been lost.

3) What did you learn from this elective period and how is it likely to affect your future career decisions?

During the two weeks I spent at The Royal London Hospital I got a flavour of the scope of paediatric anaesthetics. The team were great and I felt that I took a lot away from the rotation, despite the short period. Children pose a whole new set of anaesthetic challenges, which is a very interesting facet of this subspecialty. As a result of this I felt that I learnt a lot of new concepts and techniques during my rotation that I had not been exposed to before, such as: holding the LMA in place during the DOPs list and learning how to apply PEEP using a semi-open circuit. It was also useful to observe the ‘non-medical’ side of gas inductions and learn some methods to reduce pre-operative anxiety in children.

This elective period further confirmed that anaesthetics is the medical career that I wish to pursue. I have always been interested in child health and it is encouraging that, as a specialty, anaesthetics is diverse enough to allow trainees to be involved in this field, amongst others. I hope to work in underserved areas abroad and undertake humanitarian work in the future: anaesthetics, particularly paediatric anaesthetics, provides an excellent route into doing so.