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Trauma Training for Nonorthopaedic Doctors in Low- and Middle-income Countries

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Abstract Increasingly, nonspecialist Ghanaian doctors in district hospitals are called upon to perform a variety of surgical procedures for which they have little or no training. They are also required to provide initial stabilization for the injured and, in some cases, provide definitive management where referral is not possible. Elsewhere continuing medical education courses in trauma have improved the delivery of trauma care. Development of such courses must meet the realities of a low-income country. The Department of Surgery, Kwame Nkrumah University of Science and Technology developed a week-long trauma continuing medical education course for doctors in rural districts. The course was introduced in 1997, and has been run annually since. The trauma course specifically addresses the critical issues of trauma care in Ghana. It has improved the knowledge base of doctors, as well as their self-reported process of trauma care. Through the process we have learned lessons that could help in the efforts to improve trauma training and trauma care in other low-income countries.

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Introduction

Injuries are well documented as a leading cause of death and disability in developing countries and are increasing [5, 12, 22]. Whereas a systematic approach to reducing the burden of injury in the developed countries has yielded good dividends, this cannot be said of developing countries [17, 18]. On the other hand, there are great gains to be made in less-developed countries, where the rate of injury-related death is highest [5, 14] and where most of the world's population lives. The range of injury control activities includes surveillance, prevention and treatment. Progress in any of these areas, particularly treatment, would yield substantial improvements.

Owing to the global rate of increase of vehicles and drivers, the proportion of deaths due to road traffic accidents is expected to rise, and for every person killed, many more are injured with temporary or permanent disability [5, 13]. In Ghana, 81% of those seriously injured in road traffic accidents die before they get to the hospital [10]. Nearly one percent of all Ghanaians have an injury-related disability, 78% of which are due to extremity injuries [6]. There is a startling 8.8% yearly rate of increase in the number of casualties [21].

Several studies document high rates of medically preventable trauma deaths in developing countries, many from conditions that could be treated well in most hospitals [8, 10, 21]. It is apparent that improvement in organization and planning for trauma care could lower these rates. Analysis of interventions implemented in high-income countries documents improvements in survival can be seen with better organization and planning for trauma care services. Well-organized trauma systems have decreased mortality among all treated trauma patients by 15–20% and decreased medically preventable deaths by 50% [15, 16].

Low-cost improvements to upgrade trauma care are crucial [9, 19]. A major aspect of such improvements is maximizing training. In developed countries, the Advanced Trauma Life Support (ATLS) course has been a mainstay of Continuing Medical Education (CME) and has been used to standardize and improve trauma care [3, 4]. Regular institution of the ATLS courses has lowered the mortality rate of trauma victims [1, 2]. However, the startup cost of the ATLS course is about 45,000 pounds (approximately $80,000 US), which is an insurmountable barrier to implementation in economically less developed countries.

Low technology, a resource-challenged environment, and limited capabilities for referral are the realities of less developed countries, which must be addressed by any educational approach. In many instances, general practitioners (GPs) are required to provide initial stabilization of the trauma patients and probably definitive treatment as well, including surgical procedures, without the input of specialists [7, 11, 19]. In Ghana, GPs are routinely called upon to perform a variety of surgeries from Caesarean sections to the repair of typhoid ileal perforations. Therefore educational approaches to optimize trauma training must take into account such circumstances and realities.

The Department of Surgery, Kwame Nkrumah University of Science and Technology, developed a trauma CME course suited to the circumstances in the rural hospitals in Ghana [11]. The department also sought to evaluate how well the course was achieving its goals of imparting the essential trauma treatment skills to course participants and the delivery of trauma care. We describe this training program, share the results of a questionnaire undertaken by our department, and suggest short term educational programs may improve the delivery of trauma care.

Ghana

Ghana is situated in West Africa, along the Greenwich Meridian, in a region formerly known as Gold Coast. Ghana has a per capita gross national product (GNP) of $340. The population is over 20 million, over 60% of whom live in rural areas. Major components of the labor force include agriculture (60%), industry (15%), and service (25%). The unemployment rate is approximately 20%, and 31% of the population lives below the poverty line. There is a current massive urban migration. The government is democratically elected. There is a universal health insurance system, which is partially funded by the government of Ghana.

The network of hospitals includes district hospitals, which have up to 200 beds, are usually manned by general practitioners (GPs), and serve rural areas up to 100,000 persons. There are 10 regions and each has a regional hospital with up to 500 beds, which may have one or two specialists, including a general surgeon, and serving up to 2 million people. There are two teaching hospitals with about a thousand beds each located in the two major cities of Accra and Kumasi. There are about 1600 doctors in the country (or one doctor for every 12,500 persons); approximately 70% of doctors work in the 2 major cities, leaving less than 30% to provide services for the rural areas.

Course Development

The department sought to develop a core set of essential trauma-related surgical skills that all GPs working in rural hospitals in Ghana should have and a highly effective teaching method, designed to maximize retention in a short time period. A week-long program in four broad areas was developed: (1) initial emergency management; (2) safe management of injuries by GPs in a rural African hospital setting; (3) diagnosis of injuries that ordinarily need referral, and safe transfer of victims; and (4) what to do when such referral is difficult or impossible.

This course covers the breadth of trauma care, and employs both lectures and practical skills stations: (1) initial assessment and management of life-threatening injuries (airway, breathing, circulation, diagnosis of internal bleeding); (2) head injuries; (3) chest injuries; (4) abdominal and urologic injuries; (5) burns; (6) hand injuries; (7) facial injuries; and (8) extremity injuries. The practical component includes procedures such as airway management/intubation (using mannequins), application of plaster of Paris casts, and an entire day of animal surgery. In cases where referral is not possible, injuries to the chest and abdominal area will ideally be diagnosed and handled at the district hospitals. All doctors, regardless of level, leave the animal lab proficient in venous cut down, chest tube insertion, diagnostic peritoneal lavage and débridement of open fractures.

From an orthopaedic perspective, the course is intended to teach doctors to recognize limb-threatening injuries like open fractures and their complications and referring these patients after resuscitation, initial wound management, and immobilization. Examples of orthopaedic skills include the closed management of fractures in adults and children, débridement of open fractures, recognition and treatment of limb-threatening conditions (vascular injury, compartment syndrome), and amputations.

Pre- and Posttest

Assessment of understanding of the course content was accomplished by a test with 30 multiple choice questions

(Appendix 1). The questions are grouped into categories, and include the initial evaluation and management, torso injuries, plastic surgical injuries, orthopaedics and radiology. There was indeed improvement in the score for all major sections of the course, suggesting an increase in the trauma-related knowledge of the doctors after the course [11]. This was so across the spectrum of topics. Areas needing improvement could be stressed in future courses (Appendix 1). The evaluation revealed extremely low pretest scores for some of the frequently missed topics.

Postcourse Interviews

A postcourse questionnaire was administered approximately one year after the course was taken to assess how well the materials had assisted the physicians in improving their delivery of trauma care; many of the doctors indicated they performed more trauma-related procedures. Most of the doctors had performed basic airway management, chest tube insertion, irrigation and débridement of open fractures [11]. However, no doctor had performed any advanced airway procedure. The low utilization of advanced airway procedures may indicate the difficulty of teaching these adequately in a short period of time. It may also indicate lack of adequate airway equipment and limited facilities and infrastructure with which to deal with critically injured patients in rural hospitals [8, 9, 20]. Certainly, upgrading care for the critically injured may require more than just training doctors alone. The less emergent procedures, such as irrigation and débridement of open fractures, were also performed. Probably, the utility of the course lies in both its ability to improve trauma-related morbidity as well as decrease mortality.

Discussion

In economically developed countries, the Advanced Trauma Life Support Course (ATLS) course has been developed to standardize and improve trauma care. The startup cost creates a barrier to initiating such courses in a low-income country like Ghana. As such, there was a need to develop alternate educational approaches relevant to the realities of low-income countries. Such courses must address the resource constrained environment (low technology), in which there are limited capabilities for referral.

The trauma CME course developed by the Department of Surgery, Kwame Nkrumah University of Science and Technology specifically addresses the critical issues of trauma care in Ghana. The course has improved the knowledge base of doctors as well as their self-reported process of trauma care. Approximately 200 doctors have taken this course, and we have applied for accreditation through both the medical and dental councils. The trauma course has been accredited (CME) for residents in General Surgery. More than 120 nurses have taken the course, and we are looking at developing a similar program specifically for nurses. In addition, a recertification process has started. There are obviously lessons which could help in efforts to improve trauma training and trauma care in other low-income countries.

We recommend stakeholders (governments, international community, others) support programs which provide continuing medical education in trauma care, such as ATLS (or variations) and/or locally developed courses such as that developed at Kwame Nkrumah University of Science and Technology. The most important thing is for institutions and governments to promote whatever courses are available, to develop locally appropriate courses if none exist, and/or to import courses like ATLS if funding is available. There should be wider dissemination of existing courses, with support by governments (political and financial), so that all front line trauma care providers (e.g. doctors working in the casualty ward, surgeons taking trauma call) at the busier institutions receive such training regularly (e.g. every 4 years or so). This should apply to the teaching hospitals, regional hospitals, and district hospitals which receive a high volume of trauma cases (e.g. along busy roads, etc). Similar considerations apply to nurses working with trauma patients. There should be equal emphasis on the development and promotion of continuing nursing education in trauma care.

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Appendix 1. Content and pre- and postcourse scores of 30 questions

QUESTION	Mean % Correct (sd)		p value	
	PRE	POST		
1. Initial management of multiple trauma. Case scenario of patient who is unconscious with open fracture.	89.2 (20.8)	95.0 (10.2)	0.02	
2. Priorities in initial trauma assessment.	88.4 (17.1)	95.5 (9.5)	0.001	
3. Initial evaluation for airway obstruction.	65.8 (21.3)	82.7 (17.2)	< 0.001	
4. Maneuvers to establish patent airway.	81.2 (17.8)	91.4 (16.0)	< 0.001	
5. Tension pneumothorax, recognition and treatment.*	59.0 (25.9)	72.0 (22.0)	< 0.001	*
6. Treatment for hypotension.	78.3 (21.9)	95.5 (12.0)	< 0.001	
7. Potential sources for bleeding in hypotensive patient.	78.3 (16.6)	87.7 (15.0)	< 0.001	
8. Acute treatment of severe head injury.	62.9 (25.6)	92.0 (13.1)	< 0.001	
9. Management of prolonged unconsciousness.*	68.7 (20.5)	77.5 (16.8)	0.003	*
10. Chest tubes: indications for, set up of bottle system.	84.8 (19.2)	93.9 (12.6)	< 0.001	
11. General principals of abdominal trauma.	77.8 (20.2)	88.2 (15.4)	< 0.001	
12. Diagnosis and management of ruptured diaphragm.*	57.1 (25.8)	72.0 (27.2)	< 0.001	*
13. Evaluation of stab to anterior abdomen.*	65.3 (24.6)	62.3 (23.2)	0.41	*
14. Management of severely burned patient.	78.6 (19.5)	90.0 (15.5)	< 0.001	
15. Management of third degree burn wound.*	61.0 (28.4)	63.0 (20.9)	0.60	*
16. General principals of management of the injured hand.	84.8 (17.0)	91.8 (14.4)	0.004	
17. Management of hand lacerations.*	78.6 (22.3)	79.5 (21.0)	0.77	*
18. Management of penile injuries.*	47.5 (27.9)	72.0 (20.0)	< 0.001	*
19. Gun shot with possible urologic injury.	83.4 (22.0)	89.1 (19.9)	0.08	
20. Causes of bladder injury.	88.4 (18.0)	92.0 (12.3)	0.13	
21. Causes of urethral injury.*	72.3 (17.9)	68.2 (18.6)	0.14	*
22. Management of facial wounds after RTA.*	61.7 (25.2)	68.2 (20.0)	0.07	*
23. Suturing technique for facial wounds.*	34.7 (25.6)	55.1 (29.2)	< 0.001	*
24. Toiletting of open fractures.	79.5 (26.9)	86.8 (19.4)	0.04	
25. General principals of skeletal traction.	74.9 (23.8)	82.3 (18.3)	0.03	
26. Fractures especially prone to disability and which should probably be referred to a specialist.*	60.5 (22.5)	67.0 (25.2)	0.07	*
27. Complications of circular POP, management of numb fingers.*	70.8 (19.3)	71.4 (17.9)	0.86	*
28. Management of rib fractures.*	68.9 (21.5)	79.5 (20.6)	0.001	*
29. Characteristics of post-splenectomy sepsis.*	39.3 (19.6)	45.2 (21.8)	0.06	*
30. Interpretation of Xrays.*	38.6 (28.4)	74.0 (36.8)	< 0.001	*

* Questions in which there was either no improvement or the post-test scores remained below 80%.

The thirty questions.

QUESTION	% Correct		p value
	PRE	POST	
1. A thirty-year-old man has been involved in a road traffic accident one hour ago. He arrives to the casualty ward unconscious. He also has an open fracture of the left tibia, with a bone protruding through the skin. The initial assessment of this patient should entail:			
a. complete history and physical examination, proceeding methodically from head to toe.	80.7	88.6	0.15
b. examine the abdomen first, as this is the most likely site of internal bleeding.	92.8	98.9	0.06

Appendix. continued

QUESTION	% Correct		p value
	PRE	POST	
c. assess airway, breathing, and circulation first, before undertaking more detailed exam.	95.2	100	0.05
d. check the BP first. If this is low, examine the abdomen for internal bleeding.	86.7	93.2	0.16
e. examine the most obvious injury first, which is the open leg fracture.	90.4	94.3	0.33
2. What statements about the initial assessment of the trauma patient are true?			
a. The primary survey to look for immediate life-threatening injuries should take 1–5 minutes.	85.5	96.6	0.01
b. The primary survey to look for immediate life-threatening injuries should take 25–30 minutes.	98.8	98.9	1.00
c. A detailed secondary survey should be performed after immediately life threatening injuries have been addressed.	86.7	92.0	0.26
d. A thorough history and methodical physical exam are the best initial approach.	85.5	95.5	0.03
e. The primary survey addresses difficulties with airway, breathing, and circulation.	85.5	94.3	0.06
3. Initial evaluation for airway obstruction can include:			
a. listen for stridor or gurgling sounds.	89.2	94.3	0.22
b. feel for air movement with your hand over the patient's mouth.	50.6	94.3	< 0.001
c. see how well the patient can speak.	20.5	60.2	< 0.001
d. visualize the vocal cords with a laryngoscope.	86.7	85.2	0.77
e. listen over the chest for breath sounds.	81.9	79.5	0.69
4. Maneuvers to establish a patent airway include:			
a. suctioning of the mouth.	90.4	94.3	0.33
b. placing patient in a decubitus position (on side).	63.9	88.6	< 0.001
c. placement of a chest tube.	91.6	87.5	0.39
d. endotracheal intubation.	79.5	92.0	0.02
e. chin lift maneuver.	80.7	94.3	0.007
5. A twenty-year-old male fell from a roof top at a construction site. He is rushed in to your casualty ward. He is awake and can speak, but is extremely short of breath. He complains of pain in his chest and left abdomen. His systolic pressure is 60. Which of the following is true?			
a. The next step should be to listen for breath sounds.	57.8	63.6	0.44
b. The next step should be to examine the abdomen.	48.2	70.4	0.003
c. Tension pneumothorax is a likely diagnosis.	66.3	92.0	< 0.001
d. Treatment may need to include the placement of a chest tube.	65.1	92.0	< 0.001
e. Diagnostic peritoneal lavage (DPL) should be performed as the next step.	57.8	42.0	0.04
6. A thirty-year-old male is rushed into your casualty ward in a semi-conscious state. He has multiple injuries, a pulse of 120, and systolic BP of 60. Appropriate treatments to reverse his state of shock include:			
a. Administer steroids for the head injury.	71.1	95.5	< 0.001
b. Place a 20–22 gauge i.v.	71.1	94.3	< 0.001
c. Place a 16–18 gauge i.v.	59.0	92.0	< 0.001
d. Administer 500 mls of fluids over 1–2 hours.	96.4	97.7	0.67
e. Administer one liter of fluids over 15–30 minutes.	94.0	97.7	0.27
7. In a patient in shock after blunt trauma in which there are no open wounds and no external bleeding, possible sources of internal bleeding to account for the shock include:			
a. intracerebral bleeding.	68.7	86.4	0.005

Appendix. continued

QUESTION	% Correct		p value
	PRE	POST	
b. haemothorax.	67.5	88.6	< 0.001
c. intra-abdominal bleeding.	100	98.9	1.00
d. fracture of the femur.	59.0	69.3	0.16
e. forearm fracture.	96.4	95.5	1.00
8. After a patient has had severe head injury, useful treatments include:			
a. Administer steroids in all cases.	51.8	96.6	< 0.001
b. Administer mannitol in all cases.	59.0	88.6	< 0.001
c. Administer steroids only if BP is normal.	86.7	95.5	0.04
d. Administer mannitol only if BP is normal.	42.2	85.2	< 0.001
e. Make sure patients in shock are well resuscitated.	74.7	94.3	< 0.001
9. In patients with head injury who had prolonged unconsciousness (e.g. 5 days or more), useful treatments to prevent life-threatening complications while the patient is recovering include:			
a. Assure adequate nutrition, by NG tube if necessary.	85.5	94.3	0.06
b. Turn patient every 2–4 hours to prevent decubitus ulcers.	81.9	93.2	0.03
c. Administer antibiotics to prevent pneumonia.	26.5	23.9	0.69
d. Administer steroids to promote healing of the brain.	65.1	93.2	< 0.001
e. Administer mannitol each day until patient is out of coma.	84.3	83.0	0.81
10. Which of the following statements about chest tubes (tube thoracostomy) are true?			
a. Is often needed in blunt, but not penetrating trauma.	91.6	87.5	0.39
b. Is a frequently needed life-saving maneuver in chest trauma.	89.2	94.3	0.22
c. If a chest tube in not available for a tension pneumothroax, one can temporize by placing a needle in the second intercostal space anteriorly.	71.1	97.7	< 0.001
d. One should always wait for a sterile bottle set up.	96.4	98.9	0.36
e. If a sterile bottle set up is not available, one can temporize by putting the outside of the tubing into a basin of water on the floor.	75.9	90.9	0.008
11. In abdominal trauma:			
a. peritoneal signs are often subtle.	67.5	87.5	0.002
b. the primary factor in assessing is the accurate diagnosis of a specific type of injury.	66.3	90.9	< 0.001
c. penetrating injuries are more difficult to assess.	85.5	83.0	0.64
d. take precedence over chest injuries.	96.4	96.6	1.00
e. non-penetrating trauma is more common than penetrating trauma.	73.5	83.0	0.13
12. A teenage boy falls from his bicycle and is run over by a truck. On arrival in the emergency room, he is awake, alert, and appears frightened, but is in no distress. The chest radiograph suggests an air fluid level in the left lower lung field and the nasogastric tube seems to coil upward into the left chest.			
a. Place a left chest tube.	50.6	45.5	0.50
b. Do immediate thoracotomy.	68.7	79.5	0.10
c. Esophagogastroscopy is essential for the diagnosis.	68.7	88.6	0.001
d. Immediate laparotomy is indicated.	28.9	63.6	< 0.001
e. Remove and replace the nasogastric tube and perform diagnostic peritoneal lavage.	68.7	83.0	0.03

Appendix. continued

QUESTION	% Correct		p value
	PRE	POST	
13. A patient has been stabbed in the anterior abdomen. He has no intra-abdominal symptoms or signs. Intra-abdominal injury is ruled out by:			
a. peritoneal lavage.	44.6	18.2	< 0.001
b. probing of the wound to determine the tract.	66.3	93.2	< 0.001
c. ultrasound investigation.	62.7	61.4	0.86
d. wound exploration.	63.9	50.0	0.07
e. catheter contrast injection of the wound.	89.2	88.6	0.91
14. In a severely burned patient:			
a. the rule of tens is used to assess the body surface area involved.	57.8	88.6	< 0.001
b. associated injuries should be looked for.	72.3	80.7	0.20
c. the body mass should be determined for an accurate fluid therapy.	79.5	92.0	0.02
d. fluid replacement is unnecessary.	97.6	98.9	0.61
e. bacterial infection is easily preventable.	85.5	89.8	0.40
15. In deep burns:			
a. full thickness skin grafts are used for treatment.	43.4	30.7	0.09
b. split thickness skin grafts are used for treatment.	26.5	25.0	0.82
c. keloids and hypertrophic scars may develop later.	65.1	77.3	0.08
d. only dressing with germidine lotions and creams are permissible.	86.7	86.4	0.94
e. occlusive dressings should not be done.	83.1	95.5	0.009
16. In the injured hand:			
a. direct pressure can be used to control bleeding.	88.0	97.7	0.01
b. elevation of the affected limb can help to control bleeding.	61.4	83.0	0.002
c. direct suturing of the laceration should be done only after 6 hours.	95.2	94.3	1.00
d. the nerves and tendons are not affected.	96.4	97.7	0.67
e. blood supply is always impaired.	83.1	86.4	0.56
17. Lacerations of the hand:			
a. require meticulous hemostasis in order to prevent further complications.	65.1	63.6	0.85
b. causing tendon severance should not be managed as emergencies.	74.7	75.0	0.96
c. which are already contaminated need no immediate suturing.	66.3	77.3	0.11
d. as a rule are sutured with absorbable sutures.	91.6	89.8	0.69
e. require no antitetanus therapy.	95.2	92.0	0.40
18. In phallus (penile) injuries:			
a. penile fractures should always be surgically managed.	39.8	77.3	< 0.001
b. partial thickness skin grafts are advocated in avulsion injuries.	63.9	71.6	0.28
c. delayed skin grafting is advocated.	66.3	88.6	< 0.001
d. careful repair of tunica albuginea is essential for potency.	37.3	75.0	< 0.001
e. associated ureteric injuries should always be excluded.	30.1	47.7	0.02
19. A forty-year-old farmer was mistakenly shot by a hunter in the village of Atimtim and brought to the hospital. In this patient:			
a. no kidney injury is expected if the urine is clear.	74.7	78.4	0.57

Appendix. continued

QUESTION	% Correct		p value
	PRE	POST	
b. ureteric injuries cannot occur through gunshot wounds.	96.4	95.5	1.00
c. celiotomy (laparotomy) should be done for genito-urinary injuries only if urine is bloody.	69.9	81.8	0.07
d. If there are no x-rays, urologic injuries cannot be diagnosed.	96.4	97.7	0.67
e. urinalysis may be a useful diagnostic tool in the absence of x-rays.	79.5	92.0	0.02
20. Bladder injuries may be caused by:			
a. blunt lower abdominal trauma.	89.2	97.7	0.02
b. fracture of the pelvis.	92.8	98.9	0.06
c. improper instrumentation.	81.9	86.4	0.43
d. gunshot.	88.0	90.9	0.53
e. excessive exercise.	90.4	86.4	0.42
21. In Ghana, urethral trauma is mostly caused by:			
a. falling astride.	50.6	80.7	< 0.001
b. gunshot injury.	85.5	85.2	0.95
c. fracture of the pelvis.	68.7	54.5	0.06
d. iatrogenic injuries.	66.3	44.3	0.004
e. coital injuries.	90.4	76.1	0.01
22. Facial wounds following a road traffic accident			
a. are never suitable for immediate closure.	84.3	90.9	0.19
b. when involving the scalp are best closed in layers.	24.1	30.7	0.34
c. are best closed with size '0' sutures.	79.5	92.0	0.02
d. may bleed sufficiently to result in shock.	72.3	79.5	0.27
e. may need to be converted into those with straight edges before closure.	48.2	47.7	0.95
23. Suturing technique is different for different parts of the face.			
a. The eyelids are closed in a single layer.	21.7	45.5	0.001
b. The ala region of the nose is closed in two layers.	66.3	53.4	0.09
c. The forehead is closed in two layers.	22.9	50.0	< 0.001
d. The ear is closed in three layers.	15.7	54.5	< 0.001
e. The lip is closed in a single layer.	39.8	52.3	< 0.001
24. Concerning open (compound) fractures:			
a. they should be toiletted within 6 hours of arrival to the hospital.	74.7	79.5	0.45
b. they should be toiletted within 24 hours of arrival to the hospital.	84.3	90.9	0.19
c. toiletting principally involves rinsing skin over the wound site with antiseptic.	75.9	83.0	0.25
d. toiletting often needs to encompass opening the wound wider and débriding dead tissue.	83.1	93.2	0.04
e. they should not be sutured if there is much contamination.	79.5	87.5	0.16
25. Correct statements regarding skeletal traction include:			
a. skin traction is preferable in children.	79.5	84.1	0.44
b. for a femoral shaft fracture, an acceptable weight is 2 kg.	90.4	93.2	0.50
c. for a femoral shaft fracture, an acceptable weight is 10 kg.	43.4	64.8	0.005

Appendix. continued

QUESTION	% Correct		p value
	PRE	POST	
d. for a femoral shaft fracture, an acceptable weight is 20 kg.	83.1	90.9	0.13
e. calcaneal traction is a useful technique for femoral shaft fractures.	78.3	78.4	0.99
26. Of the following fractures, indicate as true those two which are most likely to lead to significant deformity and which should be referred to a specialist if possible. Indicate the other three as false.			
a. Displaced Colles' fracture in a four-year-old.	79.5	76.1	0.59
b. Displaced midshaft humerus fracture in a thirty-year-old.	78.3	77.3	0.87
c. Displaced supracondylar fracture of the humerus in a five-year-old.	60.2	64.8	0.54
d. Displaced supracondylar fracture of the femur in a five-year-old.	43.4	55.7	0.11
e. Displaced bimalleolar fracture in a thirty-year-old.	41.0	61.4	0.008
27. At 1 pm you reduce a forearm fracture in a twelve-year-old boy and place a circular POP. At midnight the nurses inform you that his fingers of his hand are cold, swollen, and numb. Appropriate measures to take include:			
a. remove the POP.	72.3	72.7	0.95
b. bivalve the POP.	38.6	40.9	0.75
c. raise the hand on a pillow, recheck the circulation in two hours.	57.8	55.7	0.78
d. raise the hand on a pillow, recheck the circulation in the morning.	97.6	94.3	0.44
e. administer antibiotics.	88.0	93.2	0.24
28. Which of the following statements about rib fractures are true?			
a. Strapping or taping can help to treat pain and prevent complications.	53.0	67.0	0.06
b. Adequate pain control is necessary to prevent complications.	57.8	75.0	0.02
c. Pneumonia is a likely complication.	62.7	76.1	0.06
d. Narcotic strength pain medications are not often necessary.	80.7	84.1	0.56
e. Rib fractures 9–12 on the left may indicate a splenic injury.	90.4	95.5	0.19
29. The following findings are characteristic of overwhelming post-splenectomy sepsis:			
a. shock.	83.1	85.2	0.71
b. hypoglycaemia.	9.6	21.6	0.03
c. disseminated intravascular coagulation.	68.7	71.6	0.68
d. sudden onset of symptoms.	27.7	35.2	0.29
e. headache.	7.2	12.5	0.25
30. You will be shown a series of x-rays. Please indicate which of them shows:			
1. tension pneumothorax.	49.4	59.1	0.006
2. small haemothorax with pneumothorax.	51.8	62.5	0.002
3. haemothorax.	18.1	55.7	< 0.001
4. ruptured diaphragm.	16.9	68.2	< 0.001
5. free intra-peritoneal air.	48.2	44.3	0.33

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