The assessment of trauma

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Traditionally , and especially when learning the theory of the various component parts of the assessment of the injured patient, this is done in a sequential linear fashion. However, opriate when dealing with a severely injured patient in practice, time is of the essence and when resources allow several things may be happening simultaneously – this is so-called horizontal management; while there may be a number of practical activ - ities occurring simultaneously , the coordination, assessment - and control of the situation remains as a mental exercise for the ‘hands-o ff ’ team leader. In particular, acquiring very - early definitive diagnoses with CT is increasingly important. To pr ovide such a level of care generally needs a systematic approach to concentrating resources and to preferably bringing the severely injured patient to that resource – a major trauma - system. the best understanding possible of the injuries sustained and their consequences. Forming that whole picture is a challeng ing process. The clinician must make the best use of what they know of the mechanism of injury , pre-existing patient factors and the injuries already found. Synthesising the associations of these thr ee factors will help direct attention to finding other less obvious problems. Sometimes, the pieces of the puzzle do not ‘add up’; at that point, the clinician should attempt to think ‘outside of the box’ as there may be something unexpected, such as an unknown underlying pathology leading to a patho logical fracture, or deliberately concealed, such as in NAI. For instance, a 50-year-old male restrained passenger in a car involved in a head-on collision with another vehicle may sustain rib fractures, a sternal fracture and a thoracic spine fracture but there may also be cardiac contusion and abdominal injuries. V ery ear ly CT and echocardiography may decrease the need for clinical acumen, but in many centres it is not available. The clinician then needs to use their knowledge of the mechanism of injury and the obvious rib and sternal fractures to direct their attention to excluding the less obvious but potentially life-threatening abdominal or cardiac injuries. Similarly , when sophisticated investigations and techniques are available, the clinician should not be over-reliant on them and neglect the important logical thought processes required to piece together the information that is available. It remains of value to consider how a clinician can make best use of the available information for the benefit of the patient. Summary box 26.3 The assessment of trauma /uni25CF /uni25CF /uni25CF Mechanisms Mechanisms may be broadly classified as blunt, penetrating or even of a combined nature. Table 26.1 shows examples of how knowledge of the mechanism may help detect more covert injuries. Early definitive imaging may be thought to reduce the need for such considerations, but the clinician can help the radiologist by directing their attention to potential diagnoses. The adage that ‘unless you are very fortunate you only find what you look for’ is apt. The most common mechanism involves blunt trauma, which may be either direct or indirect. In a direct mechanism, the damage is localised to the initial site of that mechanism. In contrast, in an indirect mechanism the damage occurs at a distant site after transmission of the force exerted. For example, a direct kick to the medial aspect of the mid-shaft of the tibia in a footballer by an opponent may induce an isolated transverse tibial fracture. There will be localised bruising and ecchymosis where the force was applied. - - On the other hand, a fall from a height of 1 metre with a twisting moment as the foot hits the ground can

lead to a spiral fracture of the distal tibia. In this situation the force is transmit - ted through the body’s tissues to a location some distance away from its original point of application. In this case, other injuries may have occurred along that line of transmission and should also be sought, such as a remote fibular fracture. Similarly , a motor vehicle crash associated with a point of impact of the knee joint of the driver on the dashboard of the car could induce a fracture dislocation of the acetabulum and hip joint (transmission of force from the knee joint to the hip socket – an indirect blunt mechanism) (Figure 26.5). /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF The ‘timeline concept’ previously discussed should not be taken to imply that every injury needs urgent treatment or that every injury of a similar type is of equal urgency . For instance, a tibial fracture that a footballer has sustained may be treated satisfactorily for some time after the moment of injury but, in

Appreciate the factors in the relationship: mechanism + patient factors = injuries sustained Use this to allow obvious features to lead to the discovery of less obvious injuries When the features do not appear to ‘add up’ this should be an alert for the clinician to think ‘outside the box’ and connect the /uni00A0 dots Figure 26.5 The injury force in a car accident can be transmitted from the dashboard to the knee and then to the hip, which is the site of injury. TABLE 26.1 Examples of patterns of injury. Mechanism Obvious features Covert injuries Left-sided Lateral Splenic rupture impact from compression of the Extradural road traf /f_i c pelvis haematoma accident Left-sided pneumothorax Flexion Chance fracture of Duodenal rupture distraction (lap the lumbar spine Popliteal artery belt) disruption Dislocated knee Head injury Cervical spine fracture Electrocution Burn on hand and Posterior dislocation collapse of the shoulder Dashboard Knee wound Posterior dislocation impact of the hip

(as described above) represents an emergency owing to the potential development of neurovascular complications (dam age to the sciatic nerve; avascular necrosis of the femoral head). Therefore, the clinician’s decision-making process should be informed by the peculiarities of the type of injury sustained and the anatomical location in volved. Moreover, it should be appreciated that the conduction of energy in an indirect mechanism, which is transferred via the soft tissues or fluid, can be di ffi cult both to understand and to diagnose (accurately and promptly). For example, the rise in pressure secondary to a lower abdominal force could be passed to the vascular tree (aorta), leading to unexpected haemorrhage and death. Therefore, one can argue that the e ff ects of direct mechanisms are easier to comprehend than those of indirect ones. Penetrating injuries are caused either by sharp objects or by firearms (see Chapter 34). When dealing with sharp objects, it is necessary to take into account their length, surface area the size of the entry point. For example, a pair of scissors will cause damage to the underlying tissues that they contact (skin, subcutaneous fat, fascia, etc.). Local examination will confirm the extent of the injury and the need for wound exploration. It is critical to be familiar with the relevant anatomy of the area involved to accurately assess peripheral nerve function and ten don and muscle integrity . Here again the ‘timeline concept’ of prompt assessment and response (treatment) can be crucial in cases where there is vascular injury , a compartment syndrome due to internal bleeding or even joint penetration that could lead to septic arthritis. Knowledge of the anatomical structures at risk is essential to making the right decision in a timely fash ion. This is particularly critical for penetrating wounds over the torso (see Chapter 29) because it is not always easy to establish the track that the sharp object has followed. In this context, it should not be forgotten that the abdominal structures extend higher than anticipa ted, and as high as the level of the fifth rib in

expiration. Summary box 26.4 Sharp object injuries /uni25CF /uni25CF /uni25CF Penetrating injuries caused by firearms are more di ffi cult to understand than incisional injuries caused by sharp objects. A low-velocity projectile may cause similar injuries to a knife, whereas a high-velocity projectile (bullet) causes extensive damage to the tissues as it travels, inducing lateral acceleration far from the point of impact and producing either a permanent or a temporary cavity (see Chapter 34). The importance of the temporary cavity is that it lasts for only milliseconds and is usu ally not evident during the clinical examination. It is import ant to be aware that this temporary cavity usually extends far from the boundaries of the apparent injury and there may be will ensure that the sur geon carries out su ffi cient exploration and wound excision. - Summary box 26.5 Firearm injuries /uni25CF /uni25CF /uni25CF Patient factors Every patient is di ff erent: each possesses a unique profile and medical history and so will respond di ff erently to a given trau - and matic incident. Of note, age plays an important role in this regard. Children and adults of di ff erent ages will sustain di ff er - ent injuries as a result of the same mechanism. For instance, a car hitting a pedestrian will induce di ff erent injuries in an adult from those in a child (Figure 26.6). It is important to consider the other aspects of the pa tient's history: past medical history , - medication and allergy risk will direct not only the clinical assessment but also the treatment. Obvious injuries Some injuries are very obvious and can be identified before details of the mechanism or patient are known. One can take - advantage of this, as the presence of an obvious injury can inform and lead to the identification of another that is less obvious. Obvious injuries are usually visible externally . It is therefore unsurprising that at the end of the ABCD protocol there is also an E, referring to exposure and the need to look for other signs of injury . Bruising to the scrotum of a motor - cyclist following a collision with a car suggests a pelvic fracture. Contusion over the greater trochanter of the proximal femur in an older patient experiencing di ffi culty with straight leg raise points to a fracture of the neck of the fem ur. Finger-shaped bruises on a child's arms or thighs suggest NAI. The presence of a seat belt mark on the lower abdomen of a patient involved in a car crash and who has substantial abdominal pain points to damage inside the abdomen. Thus, exposure of the trauma patient should be routine practice in order to avoid missing the 'obvious'. Hidden factors Mechanisms Sometimes, the formula 'mechanism + patient = injury' does not seem to 'add up'. If this is the case, the clinician should look further as hidden information may be contained in the mecha - nism. Occasionally , there is a deliberate attempt to misinform. While the majority of alert and orientated patients tell the truth, other patients, in order to protect themselves or others , - may fabricate a mechanism. This may mislead the clinician - and guide them to look for the wrong pattern of injuries. For instance, a patient in their twenties with a calcaneal fracture

Length of the sharp object involved is important Familiarity with local anatomy is essential Crucial point: abdominal structures at risk of injury extend high into the chest Passage of high-velocity bullets induces permanent and temporary cavitation Temporary cavitation can contain foreign material, but disappears after a few seconds and is less evident to the clinician Low-velocity bullets induce similar damage to knives

may report that this was the result of a fall into a pothole in the road, when in fact it had occurred during a burglary following a fall from a height of 10 metres. This can delay the accurate diagnosis of the specific injury and may prevent the diagnosis of other important injuries, such as a lumbar spine fracture. Although the patient should be given the chance to tell their story , it should not always be believed, particularly if there are inconsistencies. A similar situation may arise when a patient is unable to give their history of events, for instance patients who are unconscious. In this

scenario, the mechanism of injury is missing. The ph ysically and mentally vulnerable include older patients, perhaps with dementia, and very young children. The di ffi culty or inability to report the injury is compounded by the fact that it might relate to criminal activity (e.g. NAI). Param eters that should alert the clinician and raise suspicion of NAI include: /uni25CF external signs of injuries not consistent with the mecha nism reported; /uni25CF long bone fractures in a preambulatory child; /uni25CF inconsistent or changing history; /uni25CF aggressive or unusual behaviour of carers at interview; /uni25CF posterior rib injuries. Summary box 26.6 Hidden mechanisms /uni25CF /uni25CF /uni25CF /uni25CF It is absolutely paramount to make a rapid diagnosis and treat the injuries, but most importantly to protect the patient from further harm, particularly vulnerable individuals (chil - - dren and older adults). An early sign of abuse that is neglected may lead to further episodes and the potential of serious harm. For these reasons, procedures are usually in place and can be - followed by passing on the problem to the appropria te team and professionals (see Chapter 44). Another important issue is the fact that any obvious injuries may provide important evidence regarding the mechanism, which may be important to a criminal investigation. The cli - nician m ust endeavour, without compromising treatment, not

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mind that forensic evidence may be needed for a conviction at a later stage. Furthermore, the importance of this is made more apparent if we consider that the victim of an attack may subsequently be a murder victim. Patients Apart from the deliberate circumstances outlined above, where the injury and mechanism are inconsistent, the clinician should consider the possibility that the patient may have an unknown pre-existing condition. For example, when a fracture occurs following what seems to have been an insu ffi cient mechanism, the clinician should suspect that the bone was already suscep tible to fracture. Such pathological fractures may be second ary to underlying problems such as metastatic or primary tumour, osteoporosis or congenital disease. One example is the preambulatory child with multiple fractures secondary to osteogenesis imperfecta, which may mimic NAI. F to identify a pathological fracture through a primary tumour will lead to inappropriate initial management compromising appropriate cancer treatment. An initial osteoporotic or herald fracture should signal the need for appropriate investigation and, potentially , treatment to prevent further or secondary fractures. Similarly , fractures may be secondary to an undiag nosed or poorly controlled medical condition. For example, a patient presenting with a scalp laceration and a wrist fracture may have fallen as a result of a transient ischaemic attack (a /uni00A0 hidden patient factor). In this situation, it is essential to include a medical secondary survey to identify the real cause of the injuries sustained and prevent further trauma. Injuries When analysis of the formula ‘mechanism + patient = injury’ has failed to identify hidden injury , there are two other approaches: 1 the look everywhere approach; 2 the focused exclusion approach. This represents the second ary and tertiary elements of the ATLS system and involves a detailed secondary survey , from top to bottom and at di ff erent time points: soon after the initial treatment phase when measures relating to saving the patient’s life ha ve been completed, the day after injury , e.g. during a ward round, or several days after injury , e.g. when

the patient first wakes up in the intensive care unit (ICU). The implementation of whole-body CT (WBCT) (scanning the whole body) in all major trauma centres has allowed the clinical team to pick up injuries early . Such injuries would have been missed in the past when reliance was placed on the initial radiographs of the chest, pelvis and cervical spine. The threshold for using more WBCT has been lowered substantially . There is no doubt that WBCT scan algorithms have been shown to accelerate diagnostic work-up, but their e ff ect on survival is controversial. Moreover, concerns have been voiced about the overexposure of patients to radiation with the increasing and often uncritical use of this type of scan. The e ff ective radiation dose to all organs from a single full-body CT is 12–16 millisieverts (mSv). the range 5–100 /uni00A0 mSv had a statistically significant increase in the risk of solid cancers. Overall, the risks associated with one scan are relatively modest, approximately 1 in 1250 or 0.08%. How ever, it has been reported that widespread liberal use of CT is responsible for 1.5–2.0% of all cancers in the USA. Of interest, WBCT equates to 76 chest radiographs or 6 months of background radiation. It has been suggested that it should be requested wisely and that developing a triaging protocol can minimise the criticism of its overuse. This is based on the knowl - edge that some specific injuries are missed on a remarkably - regular basis. Such injury patterns include metatarsal and - metacarpal fractures, scaphoid fractures, perilunate disloca - tions and posterior shoulder dislocations . When such injuries are suspected, a detailed focused history , clinical examination and appropriate investigations should be carried out to either ailure confirm or exclude them. A high le vel of alertness and a high index of suspicion are always required to think beyond the obvious. Summary box 26.7 - Trauma assessment /uni25CF /uni25CF /uni25CF

Look everywhere approach. Focused exclusion approach. Knowledge of timelines for important diagnoses is essential Initial assessment should focus on what kills /f_i rst Screen high-risk patients before clinical signs become apparent, as it may be too late to intervene once signs develop

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The assessment of trauma

Traditionally , and especially when learning the theory of the various component parts of the assessment of the injured patient, this is done in a sequential linear fashion. However, opriate when dealing with a severely injured patient in practice, time is of the essence and when resources allow several things may be happening simultaneously – this is so-called horizontal management; while there may be a number of practical activ - ities occurring simultaneously , the coordination, assessment - and control of the situation remains as a mental exercise for the ‘hands-o ff ’ team leader. In particular, acquiring very - early definitive diagnoses with CT is increasingly important. To pr ovide such a level of care generally needs a systematic approach to concentrating resources and to preferably bringing the severely injured patient to that resource – a major trauma - system. the best understanding possible of the injuries sustained and their consequences. Forming that whole picture is a challeng ing process. The clinician must make the best use of what they know of the mechanism of injury , pre-existing patient factors and the injuries already found. Synthesising the associations of these thr ee factors will help direct attention to finding other less obvious problems. Sometimes, the pieces of the puzzle do not ‘add up’; at that point, the clinician should attempt to think ‘outside of the box’ as there may be something unexpected, such as an unknown underlying pathology leading to a patho logical fracture, or deliberately concealed, such as in NAI. For instance, a 50-year-old male restrained passenger in a car involved in a head-on collision with another vehicle may sustain rib fractures, a sternal fracture and a thoracic spine fracture but there may also be cardiac contusion and abdominal injuries. V ery ear ly CT and echocardiography may decrease the need for clinical acumen, but in many centres it is not available. The clinician then needs to use their knowledge of the mechanism of injury and the obvious rib and sternal fractures to direct their attention to excluding the less obvious but potentially life-threatening abdominal or cardiac injuries. Similarly , when sophisticated investigations and techniques are available, the clinician should not be over-reliant on them and neglect the important logical thought processes required to piece together the information that is available. It remains of value to consider how a clinician can make best use of the available information for the benefit of the patient. Summary box 26.3 The assessment of trauma /uni25CF /uni25CF /uni25CF Mechanisms Mechanisms may be broadly classified as blunt, penetrating or even of a combined nature. Table 26.1 shows examples of how knowledge of the mechanism may help detect more covert injuries. Early definitive imaging may be thought to reduce the need for such considerations, but the clinician can help the radiologist by directing their attention to potential diagnoses. The adage that ‘unless you are very fortunate you only find what you look for’ is apt. The most common mechanism involves blunt trauma, which may be either direct or indirect. In a direct mechanism, the damage is localised to the initial site of that mechanism. In contrast, in an indirect mechanism the damage occurs at a distant site after transmission of the force exerted. For example, a direct kick to the medial aspect of the mid-shaft of the tibia in a footballer by an opponent may induce an isolated transverse tibial fracture. There will be localised bruising and ecchymosis where the force was applied. - - On the other hand, a fall from a height of 1 metre with a twisting moment as the foot hits the ground can lead to a spiral fracture of the distal tibia. In this situation the force is transmit - ted through the body’s tissues to a location some distance away from its original point of application. In this case, other injuries may have occurred along that line of transmission and should also be sought, such as a remote fibular fracture. Similarly , a motor vehicle crash associated with a point of impact of the knee joint of the driver on the dashboard of the car could induce a fracture dislocation of the acetabulum and hip joint (transmission of force from the knee joint to the hip socket – an indirect

blunt mechanism) (Figure 26.5). /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF The ‘timeline concept’ previously discussed should not be taken to imply that every injury needs urgent treatment or that every injury of a similar type is of equal urgency . For instance, a tibial fracture that a footballer has sustained may be treated satisfactorily for some time after the moment of injury but, in

Appreciate the factors in the relationship: mechanism + patient factors = injuries sustained Use this to allow obvious features to lead to the discovery of less obvious injuries When the features do not appear to ‘add up’ this should be an alert for the clinician to think ‘outside the box’ and connect the /uni00A0 dots Figure 26.5 The injury force in a car accident can be transmitted from the dashboard to the knee and then to the hip, which is the site of injury. TABLE 26.1 Examples of patterns of injury. Mechanism Obvious features Covert injuries Left-sided Lateral Splenic rupture impact from compression of the Extradural road traf /f_i c pelvis haematoma accident Left-sided pneumothorax Flexion Chance fracture of Duodenal rupture distraction (lap the lumbar spine Popliteal artery belt) disruption Dislocated knee Head injury Cervical spine fracture Electrocution Burn on hand and Posterior dislocation collapse of the shoulder Dashboard Knee wound Posterior dislocation impact of the hip

(as described above) represents an emergency owing to the potential development of neurovascular complications (dam age to the sciatic nerve; avascular necrosis of the femoral head). Therefore, the clinician’s decision-making process should be informed by the peculiarities of the type of injury sustained and the anatomical location in volved. Moreover, it should be appreciated that the conduction of energy in an indirect mechanism, which is transferred via the soft tissues or fluid, can be di ffi cult both to understand and to diagnose (accurately and promptly). For example, the rise in pressure secondary to a lower abdominal force could be passed to the vascular tree (aorta), leading to unexpected haemorrhage and death. Therefore, one can argue that the e ff ects of direct mechanisms are easier to comprehend than those of indirect ones. Penetrating injuries are caused either by sharp objects or by firearms (see Chapter 34). When dealing with sharp objects, it is necessary to take into account their length, surface area the size of the entry point. For example, a pair of scissors will cause damage to the underlying tissues that they contact (skin, subcutaneous fat, fascia, etc.). Local examination will confirm the extent of the injury and the need for wound exploration. It is critical to be familiar with the relevant anatomy of the area involved to accurately assess peripheral nerve function and ten don and muscle integrity . Here again the ‘timeline concept’ of prompt assessment and response (treatment) can be crucial in cases where there is vascular injury , a compartment syndrome due to internal bleeding or even joint penetration that could lead to septic arthritis. Knowledge of the anatomical structures at risk is essential to making the right decision in a timely fash ion. This is particularly critical for penetrating wounds over the torso (see Chapter 29) because it is not always easy to establish the track that the sharp object has followed. In this context, it should not be forgotten that the abdominal structures extend higher than anticipa ted, and as high as the level of the fifth rib in expiration. Summary box 26.4 Sharp object injuries /uni25CF /uni25CF /uni25CF Penetrating injuries caused by firearms are more di ffi cult to understand than incisional injuries caused by sharp objects. A low-velocity projectile may cause similar injuries to a knife, whereas a high-velocity projectile (bullet) causes extensive damage to the tissues as it travels, inducing lateral acceleration far from the point of impact and producing either a permanent or a temporary cavity (see Chapter 34). The importance of the temporary cavity is that it lasts for only milliseconds and is usu ally not

evident during the clinical examination. It is import ant to be aware that this temporary cavity usually extends far from the boundaries of the apparent injury and there may be will ensure that the sur geon carries out su ffi cient exploration and wound excision. - Summary box 26.5 Firearm injuries /uni25CF /uni25CF /uni25CF Patient factors Every patient is di ff erent: each possesses a unique profile and medical history and so will respond di ff erently to a given trau - and matic incident. Of note, age plays an important role in this regard. Children and adults of di ff erent ages will sustain di ff er - ent injuries as a result of the same mechanism. For instance, a car hitting a pedestrian will induce di ff erent injuries in an adult from those in a child (Figure 26.6). It is important to consider the other aspects of the pa tient's history: past medical history , - medication and allergy risk will direct not only the clinical assessment but also the treatment. Obvious injuries Some injuries are very obvious and can be identified before details of the mechanism or patient are known. One can take - advantage of this, as the presence of an obvious injury can inform and lead to the identification of another that is less obvious. Obvious injuries are usually visible externally . It is therefore unsurprising that at the end of the ABCD protocol there is also an E, referring to exposure and the need to look for other signs of injury . Bruising to the scrotum of a motor - cyclist following a collision with a car suggests a pelvic fracture. Contusion over the greater trochanter of the proximal femur in an older patient experiencing di ffi culty with straight leg raise points to a fracture of the neck of the fem ur. Finger-shaped bruises on a child's arms or thighs suggest NAI. The presence of a seat belt mark on the lower abdomen of a patient involved in a car crash and who has substantial abdominal pain points to damage inside the abdomen. Thus, exposure of the trauma patient should be routine practice in order to avoid missing the 'obvious'. Hidden factors Mechanisms Sometimes, the formula 'mechanism + patient = injury' does not seem to 'add up'. If this is the case, the clinician should look further as hidden information may be contained in the mecha - nism. Occasionally , there is a deliberate attempt to misinform. While the majority of alert and orientated patients tell the truth, other patients, in order to protect themselves or others , - may fabricate a mechanism. This may mislead the clinician - and guide them to look for the wrong pattern of injuries. For instance, a patient in their twenties with a calcaneal fracture

Length of the sharp object involved is important Familiarity with local anatomy is essential Crucial point: abdominal structures at risk of injury extend high into the chest Passage of high-velocity bullets induces permanent and temporary cavitation Temporary cavitation can contain foreign material, but disappears after a few seconds and is less evident to the clinician Low-velocity bullets induce similar damage to knives

may report that this was the result of a fall into a pothole in the road, when in fact it had occurred during a burglary following a fall from a height of 10 metres. This can delay the accurate diagnosis of the specific injury and may prevent the diagnosis of other important injuries, such as a lumbar spine fracture. Although the patient should be given the chance to tell their story , it should not always be believed, particularly if there are inconsistencies. A similar situation may arise when a patient is unable to give their history of events, for instance patients who are unconscious. In this scenario, the mechanism of injury is missing. The ph ysically and mentally vulnerable include older patients, perhaps with dementia, and very young children. The di ffi culty or inability to report the injury is compounded by the fact that it might relate to criminal activity (e.g. NAI). Param eters that should alert the clinician and raise suspicion of NAI include: /uni25CF external signs of injuries not consistent with the mecha nism reported; /uni25CF long bone fractures in a preambulatory child; /uni25CF inconsistent or changing history; /uni25CF aggressive or unusual behaviour of carers at

interview; /uni25CF posterior rib injuries. Summary box 26.6 Hidden mechanisms /uni25CF /uni25CF /uni25CF /uni25CF It is absolutely paramount to make a rapid diagnosis and treat the injuries, but most importantly to protect the patient from further harm, particularly vulnerable individuals (chil - - dren and older adults). An early sign of abuse that is neglected may lead to further episodes and the potential of serious harm. For these reasons, procedures are usually in place and can be - followed by passing on the problem to the appropria te team and professionals (see Chapter 44). Another important issue is the fact that any obvious injuries may provide important evidence regarding the mechanism, which may be important to a criminal investigation. The cli - nician m ust endeavour, without compromising treatment, not

Adult 15 years 10 years Figure 26.6 Body proportions at various ages and the anatomical location of injuries when hit by a car. 19.0 cm (9 in) (9 in) 17.8 cm 16.5 cm 15.2 cm (7.5 in) (7 in) (6.5 in) (6 in) Adult 15 y 10 y 5 y 3 y 1 y 5 years 3 years 1 year The vast majority of conscious patients will tell the truth Patients involved in criminal activity may not tell the truth Fear of abuse may prevent vulnerable patients from telling the truth Clinicians have the responsibility to take action when NAI is suspected

mind that forensic evidence may be needed for a conviction at a later stage. Furthermore, the importance of this is made more apparent if we consider that the victim of an attack may subsequently be a murder victim. Patients Apart from the deliberate circumstances outlined above, where the injury and mechanism are inconsistent, the clinician should consider the possibility that the patient may have an unknown pre-existing condition. For example, when a fracture occurs following what seems to have been an insu ffi cient mechanism, the clinician should suspect that the bone was already suscep tible to fracture. Such pathological fractures may be second ary to underlying problems such as metastatic or primary tumour, osteoporosis or congenital disease. One example is the preambulatory child with multiple fractures secondary to osteogenesis imperfecta, which may mimic NAI. F to identify a pathological fracture through a primary tumour will lead to inappropriate initial management compromising appropriate cancer treatment. An initial osteoporotic or herald fracture should signal the need for appropriate investigation and, potentially , treatment to prevent further or secondary fractures. Similarly , fractures may be secondary to an undiag nosed or poorly controlled medical condition. For example, a patient presenting with a scalp laceration and a wrist fracture may have fallen as a result of a transient ischaemic attack (a /uni00A0 hidden patient factor). In this situation, it is essential to include a medical secondary survey to identify the real cause of the injuries sustained and prevent further trauma. Injuries When analysis of the formula ‘mechanism + patient = injury’ has failed to identify hidden injury , there are two other approaches: 1 the look everywhere approach; 2 the focused exclusion approach. This represents the second ary and tertiary elements of the ATLS system and involves a detailed secondary survey , from top to bottom and at di ff erent time points: soon after the initial treatment phase when measures relating to saving the patient’s life ha ve been completed, the day after injury , e.g. during a ward round, or several days after injury , e.g. when the patient first wakes up in the intensive care unit (ICU). The implementation of whole-body CT (WBCT) (scanning the whole body) in all major trauma centres has allowed the clinical team to pick up injuries early . Such injuries would have been missed in the past when reliance was placed on the initial radiographs of the chest, pelvis and cervical spine. The threshold for using more WBCT has been lowered substantially . There is no doubt that WBCT scan algorithms have been shown to accelerate diagnostic work-up, but their e ff ect on survival is controversial. Moreover, concerns

have been voiced about the overexposure of patients to radiation with the increasing and often uncritical use of this type of scan. The e ff ective radiation dose to all organs from a single full-body CT is 12–16 millisieverts (mSv). the range 5–100 /uni00A0 mSv had a statistically significant increase in the risk of solid cancers. Overall, the risks associated with one scan are relatively modest, approximately 1 in 1250 or 0.08%. How ever, it has been reported that widespread liberal use of CT is responsible for 1.5–2.0% of all cancers in the USA. Of interest, WBCT equates to 76 chest radiographs or 6 months of background radiation. It has been suggested that it should be requested wisely and that developing a triaging protocol can minimise the criticism of its overuse. This is based on the knowl - edge that some specific injuries are missed on a remarkably - regular basis. Such injury patterns include metatarsal and - metacarpal fractures, scaphoid fractures, perilunate disloca - tions and posterior shoulder dislocations . When such injuries are suspected, a detailed focused history , clinical examination and appropriate investigations should be carried out to either ailure confirm or exclude them. A high le vel of alertness and a high index of suspicion are always required to think beyond the obvious. Summary box 26.7 - Trauma assessment /uni25CF /uni25CF /uni25CF

Look everywhere approach. Focused exclusion approach. Knowledge of timelines for important diagnoses is essential Initial assessment should focus on what kills /f_i rst Screen high-risk patients before clinical signs become apparent, as it may be too late to intervene once signs develop

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