

# Harvest Time Danger: Problem Handouts



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# Harvest Time Danger

## Part 1



Tom, a 36-year-old, right hand-dominant male farmer, was working in his fields late one October evening, in the hopes of being able to get all of his crops harvested and into town for drying prior to the first snow. Tom had been raised on a farm, and since returning from college it was the only job he had ever had or wanted to have. As he was working late that night he remember his father's cautionary words about being careful around farm machinery—especially when tired. As he was working the combine into the last few acres of the cornfield field he noticed that this was the area where the herbicide, for some unknown reason, just hadn't taken like it did in other areas. As a result the weeds were more frequent, and much thicker. More than once Tom had to stop the combine, disengage the corn head and manually remove the weeds from the combine head. In addition, because he was running low on diesel fuel Tom was concerned that the increasingly frequent need to stop the combine, disengage the head, manually remove the weeds and other "garbage" clogging the picker, climb back into the cab and restart everything was increasing his chances of having to shut the combine down and walk across the field to his pickup so he could refuel. And, as the outside temperature steadily dropped, the large diesel engine of the combine would became harder and harder to restart should he need to refuel.

As he was making his next to last turn down a section of the field, the head of the combine once again became entangled with weeds. As Tom climbed down from the cab of the combine he was fighting fatigue as a result of his long day in the field; as a result he forgot to disengage the corn head. Upon seeing the clog he instinctively reached between the rows of the picker without thinking. Immediately his right sleeve was pulled into the machinery. Instinctively Tom quickly fought the inward pull of the machinery as he yanked his arm back, all the time feeling considerable tearing and grinding. He then lost consciousness.

When he regained consciousness sometime later, Tom feebly unclipped his cell phone from his belt with his left hand and called the farmhouse. The local volunteer EMS team was out in the field with their ambulance within 5 minutes. The EMS team was able to stabilize the patient and transport him the emergency room at The University of Wisconsin Hospitals in Madison, where the attending 4th-year medical student, under the guidance of the senior ER resident, made his initial examination. The examination by the med student yielded the following information:

### ***Physical Examination:***



- The EMS team informed the physician that they found the patient lying on the ground next to the combine in the supine position. His right shoulder was hyper abducted with his elbow flexed and his hand lying above his head. His head was soaked in blood. They chose to immobilize him in this position.
- The patient appeared stuporous. Although both pupils were reactive to light, he had a "glazed" look.
- The patient's carotid pulse was regular and his blood pressure was 105/70. IV fluids and oxygen had been started at the accident site, and were continued in the ER by the physician.
- A preliminary neurological and ROM (range of motion) examination by the 4th-year med student demonstrated the following:
  1. Decreased wrist extension
  2. When questioned by the physician the patient complained of a numbness sensation of the dorsum of the hand, with paresthesia to the index and middle fingers. A "painful numbness" seemed to travel down the arm.
- The right radial pulse was palpable and symmetric with the contralateral side.

As his immediate condition was not life threatening, Tom was stabilized. However, the patient would need to undergo extensive surgery, so the ER resident paged a neurosurgeon and an orthopedic surgeon before the 4th-year medical student removed any of Tom's clothing.

The medical student made notes concerning his initial diagnosis and then made a verbal diagnosis to the attending ER resident.

***Question:***

Based upon the medical student's preliminary neurological examination, what neuromuscular damage Tom had sustained in his injury? Defend your answer.

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## Part 2

The neurosurgeon and orthopedic surgeons arrived at the ER. The medical student then pieced the chain of events together for the surgeons. In addition, they were briefed by the 4th-year medical student regarding her initial diagnosis. The medical student was then instructed in how to remove the patient's clothing above the waist. The following was determined upon examination by the neurosurgeon and orthopedic surgeon:

### ***Physical Examination:***

- A 10-cm laceration was noted in his right axilla. The wound was grossly contaminated with silage.
- The right humeral head protruded through the wound and lay along his right chest wall.
- Neurological examination by the medical student was confirmed. Detailed examination of sensation to a pin test revealed hypoesthesia over the dorsum of the hand between the thumb and index finger, as well as the index and long fingers. There is clear weakness of the extensor muscles of the wrist and triceps muscles. The shoulder girdle muscles could not be examined well due to the position and extreme pain of the shoulder.
- Radial pulse examination by the medical student was confirmed.
- Anteroposterior and axillary radiographs of the right shoulder were ordered.

Surgery was performed, the shoulder was reduced, and the axillary wound was extended, cleaned, and debrided. The wound was packed open, and the right upper appendage was placed in a shoulder immobilizer. Repeated irrigation and debridement was performed in the operating room 24 and 48 hours after admission to the hospital. The wound was found to be free of necrotic or foreign material, and was closed after suction drainage.

Immobilization was discontinued four weeks after surgery, and physical therapy was instituted for right shoulder active and passive ROM (range of motion) exercises. The only neurological defect observed at four weeks was a significant decrease in sensation over the posteromedial aspect of the arm. In addition, the patient demonstrated preliminary atrophy and weakness of the deltoid. The neurologist's evaluation and electromyography (neurophysiologic testing of the peripheral nerves and muscles) found clear evidence of denervation (axon loss) and a reduced number of recruitable motor unit potentials (electrical activity of muscle voluntary muscle activity). After eight months of physical therapy the patient demonstrated the following:

- Significant atrophy and weakness of the deltoid and triceps.
- Continued wrist extension dysfunction
- Continued hypoesthesia of the dorsum of the hand, with extension to the index and middle fingers
- Right shoulder passive ROM was as follows: 80 degrees flexion, 60 degrees abduction, 5 degrees lateral (external) rotation, and 40 degrees medial (internal) rotation.

A manipulation was performed under general anesthesia, and 165 degrees of flexion, 160 degrees of abduction, 80 degrees lateral rotation, and 70 degrees of medial rotation were obtained. Physical therapy was continued for four additional weeks.

Four months after the conclusion of physical therapy the patient's ROM had deteriorated back to his pre-manipulation level. A second manipulation under general anesthesia was performed, and a passive constant passive motion machine was used in the immediate postoperative period. Physical therapy was continued once again, but ROM continued to deteriorate.

***Utilizing sound anatomical logic, consider the following questions:***

1. What is your diagnosis for this patient?
2. The shoulder joint is a synovial joint with particular specializations that enable its characteristic range of motion. Which portion(s) of the capsule of this joint would be damaged as a result of Tom's injury, if any? Describe the anatomy of the capsule of the glenohumeral joint.
3. Would any particular type of fracture typically accompany such an injury? If so please define it/them.
4. After reviewing the anatomy of the muscles of the pectoral region and arm, what tendons of origin and/or insertion might have been damaged in this accident? Give a detailed description of these structures. Justify your answer.
5. In addition to the joint capsule, what structures of the joint in question would have a very high chance of being damaged in this type of injury? Give a detailed anatomical description of these structures, as well as their proposed functions.
6. Explain why the patient experienced the lack of sensory function in the injured upper extremity. Be detailed in your explanation of the structures involved in the injury. In addition, trace the origin of any injured structure back to its exit from the spinal cord.
7. Utilizing sound kinesiology logic, explain the limits to normal active and passive ROM of the glenohumeral joint. Then provide logical explanations for the patient's repeated decline in ROM following physical therapy and manipulation under general anesthesia. Demonstrate sound understandings of anatomical and kinesiology concepts in your explanation.

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## Team and Self Assessment Form

Your name: \_\_\_\_\_

Please use the rating scale below to describe how you and your team members performed on each of the tasks listed associated with your PBL group's activities. The purpose of the grading is not to divide groups but to reward those making above average effort and to encourage those not giving their fair share to the group overall effort.

5 if Always    4 if Very Often    3 if Sometimes    2 if Rarely    1 if Never

PBL Group Number: \_\_\_\_\_

Please fill in PBL Group Members' *Last* Names (including your own)

Names                      \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_

Completed assigned tasks \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_

Contributed valuable  
information to the group    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_

Attended group meetings \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_

Was honest in reporting  
progress about his/her  
assigned tasks                      \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_

Participated in writing  
final report                              \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_



Now, ***please circle*** the rating below that you feel you would best describe your group's overall performance:

Very good

Good

Barely Acceptable

Poor

Very Poor



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## PBL Self Evaluation Form

This evaluation form will not be utilized in assigning any grades. However, it is beneficial to reflect on any progress that you might have made in various areas as a result of participating in a PBL course. Therefore, please evaluate yourself utilizing the following scale.

Scale:

- 5 = Strongly agree
- 4 = Agree
- 3 = Neutral
- 2 = Disagree
- 1 = Strongly disagree

Your name: \_\_\_\_\_

As a result of my participation in PBL in Human Anatomy I feel that I have improved in the areas of:

1. Effective group participation \_\_\_\_\_
2. Effective group communication \_\_\_\_\_
3. Evaluation of myself (self evaluation) \_\_\_\_\_
4. Evaluation of others (peer evaluation) \_\_\_\_\_
5. Acquiring information to solve complex problems \_\_\_\_\_
6. Evaluation of the quality of information needed  
to solve complex problems \_\_\_\_\_
7. Working effectively with others \_\_\_\_\_





8. Higher-order, critical thinking skills \_\_\_\_\_

Overall improvement rating of yourself: \_\_\_\_\_

5 = excellent; 4 = good; 3 = average; 2 = needs work; 1 = poor

