Whitewater Canoeing and Rafting

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What is it?

• ‘Canoeing’ = overarching term for all canoe and kayak activities (although most of the disciplines have specific canoe and kayak classes)

• Modern canoeing is a diverse sport

• Whitewater kayaking, rafting and canoeing are fast becoming one of the most popular adventure/extreme sports

• The International Canoe Federation (ICF) oversees competitive canoeing across 11 disciplines that encompass a wide range of different craft, paddles, and water conditions

• Principal ICF competitive whitewater disciplines: canoe slalom, wildwater canoeing, and canoe freestyle

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What is it?

• The disciplines of rafting and surf/waveski also take place on whitewater

• At the recreational level - often described as playboating, whitewater touring, or river running

• The most challenging and extreme whitewater paddling involves descending grade V and VI rapids, including shooting waterfalls, as well as exploring new or seldom-navigated rivers in remote wilderness locations.
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- **Rafting** - Racing with 4-8 people in raft. The WC include sprint, head-to-head, slalom and downriver events
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- **Surf/waveski** - Stunts/maneuvers performed while surfing a wave into shore
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# International Scale of River Difficulty

<table>
<thead>
<tr>
<th>Grade</th>
<th>Water conditions</th>
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<tbody>
<tr>
<td>I</td>
<td>Moving water with riffles and small waves. Few obstructions, all obvious, and easily missed with little training. Risk to swimmers is slight; self-rescue is easy.</td>
</tr>
<tr>
<td>II</td>
<td>Straightforward rapids with wide, clear channels. Occasional maneuvering required, but rocks and medium-sized waves are easily avoided.</td>
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<tr>
<td>III</td>
<td>Moderate rapids that include irregular waves, strong eddies, and a powerful current. Good boat control and regular maneuvering required to avoid obstacles (boulders &amp; small drops). More pronounced obstacles (large waves or strainers) may be present but are easily avoided.</td>
</tr>
<tr>
<td>IV</td>
<td>Intense, powerful, turbulent, but predictable rapids often featuring large, unavoidable waves and holes. Requires precise boat handling and fast maneuvers under pressure. Scouting may be necessary the first time down. Risk of injury to swimmers is moderate to high, and a strong eskimo roll is highly recommended.</td>
</tr>
<tr>
<td>V</td>
<td>Extremely long, obstructed, or very violent rapids that expose a paddler to added risk. Frequent large, unavoidable waves, and holes or steep, congested chutes with complex, demanding routes. Few eddies that are small, turbulent, and difficult to reach. Scouting is recommended but often difficult. Swims are dangerous, and rescue is difficult even for experts. A very reliable eskimo roll, proper equipment, extensive experience, and rescue skills are essential.</td>
</tr>
<tr>
<td>VI</td>
<td>These runs have almost never been attempted and often exemplify the extremes of difficulty, unpredictability, and danger. The consequences of errors are very severe, and rescue may be impossible. For teams of experts only, at favorable water levels, after close personal inspection and taking all precautions.</td>
</tr>
</tbody>
</table>
What do we need?

• Whitewater canoes and kayaks - different shapes and sizes, depending on the purpose and expected water conditions:

- Craft designed for linear speed are long and sleek to reduce drag, e.g., wildwater, touring, or marathon kayaks (3.5–5.2m)

- Slalom, freestyle, and surf craft are typically shorter for increased maneuverability (3m and <2m, respectively) and flat-bottomed for greater stability
What do we need?

- Decked craft - For higher grade whitewater (III+)
- Squirt boats – a form of freestyle kayak that can perform subsurface maneuvers even on flat water
- Competition canoes and kayaks are made of composite materials to minimize weight and maximize performance
- Recreational canoes and kayaks made of polyethylene plastic to maximize durability (at the cost of increased weight)
Canoes, Kayaks, Rafts
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Canoes, Kayaks, Rafts
**Paddle design**

- Largely dependent on the craft and canoeing discipline plus the physique and ability of the paddler.
- Craft with greater linear speed tend use longer paddles that have a larger blade area. For these faster craft, kayak paddles with a greater feather angle (45–85°) and winged blades ("spoon" shaped with a distinct upper lip) are commonly used.
- Cranked shaft paddles are popular among slalom kayakers and have been suggested to improve performance and reduce injury risk.
Paddle design

Paddle designs

Unfeathered

Feathered

Feathered with a cranked shaft

Square-ended

Assymetric

Wing
Safety

- **Personal flotation devices (PFD)** are essential personal equipment for all Whitewater paddle sports.
- A high proportion of fatalities (68% and 92%) were not wearing a PFD.
- A **helmet** is also essential personal equipment.
- More extreme Whitewater helmets incorporating jaw and/or face protection may also be appropriate.
- **Face guards** are more relevant for rafters due to the higher incidence of reported facial injuries.
Safety

- Water Temperature – Alpine or mountain rivers - **wet or dry suits** are an important safety precaution, due to the risk of hypothermia during a prolonged exposure

- **Throw bags** are an important in case of capsizing/flipping over, enabling a swimmer to grab the rope and be pulled to safety.
Safety
Safety
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Safety
Safety
Safety
Epidemiology

• The incidence of Whitewater injuries has been estimated as 4.5 and 5.2 injuries per 1,000 paddler days among recreational and competitive slalom canoeists and kayakers (a similar injury incidence to alpine skiing, but higher than cross-country skiing or windsurfing)

• The injury incidence in commercial rafters is lower with 0.26–0.44 injuries per 1,000 paddler days

• As with most sports - the incidence of Whitewater injuries rises with increased exposure and is substantially greater during competition than training
Epidemiology

• Submersion accidents are the primary life-threatening hazard, possibly accounting for ~1/3 of all Whitewater injuries that include drowning, near drowning, and impact-related trauma while submerged.

• Fatalities are relatively rare, occurring at a rate of 8.7 per 1,000,000 user days for rafters, canoeists, and kayakers, which is similar to trekking.

• Most occur in inexperienced paddlers in rivers/conditions beyond their skills.

• The primary causes of drowning in whitewater are entrapment, blunt head trauma, or hypothermia leading to disorientation or loss of consciousness.
Epidemiology

- Sudden immersion in cold water can cause hyperventilation, bronchospasm, and even cardiac arrest

- Submersion accidents and injuries primarily occur during a capsize or when a paddler is separated from their craft downriver

- Capsized paddlers and swimmers are susceptible to hematomas, contusions, abrasions, and lacerations from contact with rocks and other objects, while carried downstream.
<table>
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<tr>
<th>Environmental</th>
<th>Chronic Overuse</th>
<th>Acute Injuries</th>
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</thead>
<tbody>
<tr>
<td>Drownings/near drownings</td>
<td>Tendinopathies of the wrist, forearm, elbow, and</td>
<td>Lacerations/abrasions</td>
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<tr>
<td>Blisters/calluses on hands</td>
<td>Muscle strain of the lower back and</td>
<td>Contusion/hematomas</td>
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<tr>
<td>Fungal and bacterial skin infections</td>
<td>Rotator cuff impingement</td>
<td>Shoulder dislocations</td>
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<tr>
<td>Gastroenteritis</td>
<td>Rib stress fractures</td>
<td>Fractures</td>
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<tr>
<td>Otitis media and otitis externa</td>
<td></td>
<td>Head and face injuries</td>
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<tr>
<td>Cold/heat injury</td>
<td></td>
<td>Muscle strains and joint sprains</td>
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<tr>
<td>Leptospirosis</td>
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Injuries – Where?

• Being a predominantly upper body sport, the majority of injuries in canoeists and kayakers involve the upper extremities (wrist, forearm, elbow, and shoulder)

• Rafters have a different pattern of injury with more face (33 %) and knee injuries (15 %) and fewer shoulder injuries (6 %)

• The shoulder was reported to be the most common site for severe injury in canoe/kayak paddlers, with 15 % reporting at least one dislocation

• More than 50% of elite slalom paddlers reported a
Injuries – When?

- More than 50 % of all rafting injuries occur on the raft (collisions with other rafters, impacts from paddles or other equipment, and entanglement of extremities within the raft)

- 40 % of rafting injuries occur when paddlers are ejected from the raft

- In whitewater kayakers, 87 % of injuries occurred while in the boat, 8 % when in the water having abandoned their craft, and 5 % while walking or portaging
Acute Injuries

• The majority of Whitewater injuries are of an acute traumatic nature - 57–61 % of all injuries

• The most common acute injuries in canoe/kayak paddlers were sprains and strains (26-35 % of acute injuries), tendonitis (20 %) lacerations (17 %), and contusions (17 %)

• In rafters: lacerations (33 %), strains and sprains (23 %), fractures (23 %), and contusions/bruises (10%)
Acute Injuries

• Dislocations and subluxations commonly occur when a paddler is forced to brace strenuously to avoid capsize

• Extreme bracing or support strokes involve a high degree of shoulder abduction, which if pronounced and combined with ER and extension can lever the humeral head out of the glenoid fossa

• In this position the musculature that typically spans the anterior of the joint (subscapularis, biceps brachii, anterior deltoid, and pectoralis major) is lifted above the joint, resulting in limited anterior stabilization

• Good technique - limited shoulder abduction, extension, and external rotation is thought to reduce the risk of this injury

• Involves keeping the elbow flexed in front of and below the shoulder and the hand in front of the elbow
Paddling Technique
Major Traumatic Injuries

• No scientific data, mostly press reports

• Can occur during higher grade descents where drops/falls are often involved

• Include vertebral compression fractures, long bone and pelvic fractures, abdominal/chest trauma, and head injuries

• These injuries frequently cause temporary or permanent paralysis
Chronic Injuries

• Common in **canoeists and kayakers** (25–40 % of all injuries)

• Less frequent in **rafters** (13 %) likely due to the single or occasional participation of commercial rafters

• The most common types of chronic injuries among **recreational canoe and kayak paddlers** are tendinitis (44 %) and sprain/strain (27 %)
Chronic Injuries

• Kayak paddlers are especially prone to overuse forearm and wrist injuries due to the combination of repetitive wrist flexion and extension with intense gripping.

• The best known forearm injury is extensor tenosynovitis - characterized by inflammation of the tendon sheath within the dorsal aspect of the wrist/forearm.

• Typically occurs in the control hand of kayakers.

• Reported to be the most common injury in Olympic kayakers and canoeists.
Chronic Injuries

- Flexor tendinitis is thought to be more common in single canoe paddlers who may have to “J” stroke extensively to maintain their course and overgripping the paddle shaft.

- Other conditions: carpal tunnel syndrome, median nerve entrapment (due to flexor tendon hypertrophy), De Quervain syndrome, forearm exertional compartment syndrome.
Chronic Injuries – Shoulder

• Rotator cuff tendinopathy - In canoe paddling impingement of the supraspinatus is a common overuse injury due to the continually abducted and IR position impinging the supraspinatus tendon and subacromial bursa against the acromion and CA ligament

• Less frequent in kayakers - the paddle shaft is less vertically placed and requires less shoulder abduction
Chronic Injuries – Elbow

- Tendinopathy and epicondylitis - most common

- Triceps tendinopathy can occur particularly at the distal insertion of canoeists

- Medial epicondylitis - caused by excessive wrist flexion during the pulling action and therefore tends to occur in single canoe paddlers due to repetitive “J” stroking

- Lateral epicondylitis - caused by repetitive extension
Chronic Injuries – Back

- **Kayakers** are prone to paraspinal fatigue and lumbosacral strain due to prolonged sitting and repetitive, heavy rotational and shear loads.

- In **competitive canoeists** and kayakers (predominantly flatwater paddlers), 23% experienced low back pain, limited back movement, or numbness.

- Among **elite competitors** the incidence has been reported between 20% - 52%.

- This included: spondylolysis (17%), myofascial pain syndrome (16%), and spondylosis deformans (13%).

- Upon X-ray examination 86% of elite flatwater paddlers (86%) had concave vertebrae and assumed ballooning of the intervertebral disks (vs. <30% in male athletes generally), due to vertebral degeneration/
Environmental Injuries and Illnesses

- 33% of all injuries in competitive canoers/kayakers – related to environmental stresses
- Exposure to water – skin, gastrointestinal
- Extremes of temperature
- **Skin:** mild skin infections, folliculitis, fungal infections, blisters
- **Ears:** otitis media/externa are common
Environmental Injuries and Illnesses

• GI: water cleanliness + exercise induced lowered immunity
• Diarrhea, Giardiasis infection
• Cold/Heat illness: Hypothermia, heat stroke
Injury Reduction

• Well maintained equipment

• Good physical capability

• Sufficient training

• Improve strength and balance of scapular, gleno-humeral and core stabilizers

• Practicing extreme conditions and scenarios
Rehabilitation and Return to Sport

Initial phase:
NO PADDLING
Consider cross training to maintain aerobic/anaerobic and cardiovascular fitness as required.
Consider continuing strength training for unaffected body areas.

Return to flatwater:
Water with little or no flow.
Initial light pressure through paddle, straight lines, minimal turns.
Increase in power through stroke, straight lines.
Re-introduce turning skills
Next step is the above on moving flatwater.

Return to whitewater:
Initial work in straight lines.
Build back in direction changes / turns in slower moving sections building back to faster water.
Re-introduce upstream paddling and work on manoeuvres needing specific attention due to nature of injury.
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• Chronic injuries – tendinitis of the wrist and forearm, LBP
• Environmental injuries and illnesses – common, be aware
Danger can come from anywhere...
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Thank You
17th ESSKA Congress

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