Emergency Medicine Interest Group

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Pre-hospital Workshop

Station 4 – Pre-hospital Environment & Management (Coggins and Colleagues)

Suggested Learning Objectives and Discussion Points:

1. Overview of Pre-hospital and Retrieval Medicine
2. Human factors
3. Acute crisis resource management skills
4. Leadership and Followership
5. Communication Skills (documentation and handover)
6. Team Roles + Checklists
7. Aviation Medicine (some specific issues)
8. Disasters – learning points from well-known events

Target Group:

- Medical Students

Resources:

- Indoor Discussion (Facilitated) with pictures
- 1-2 Facilitators

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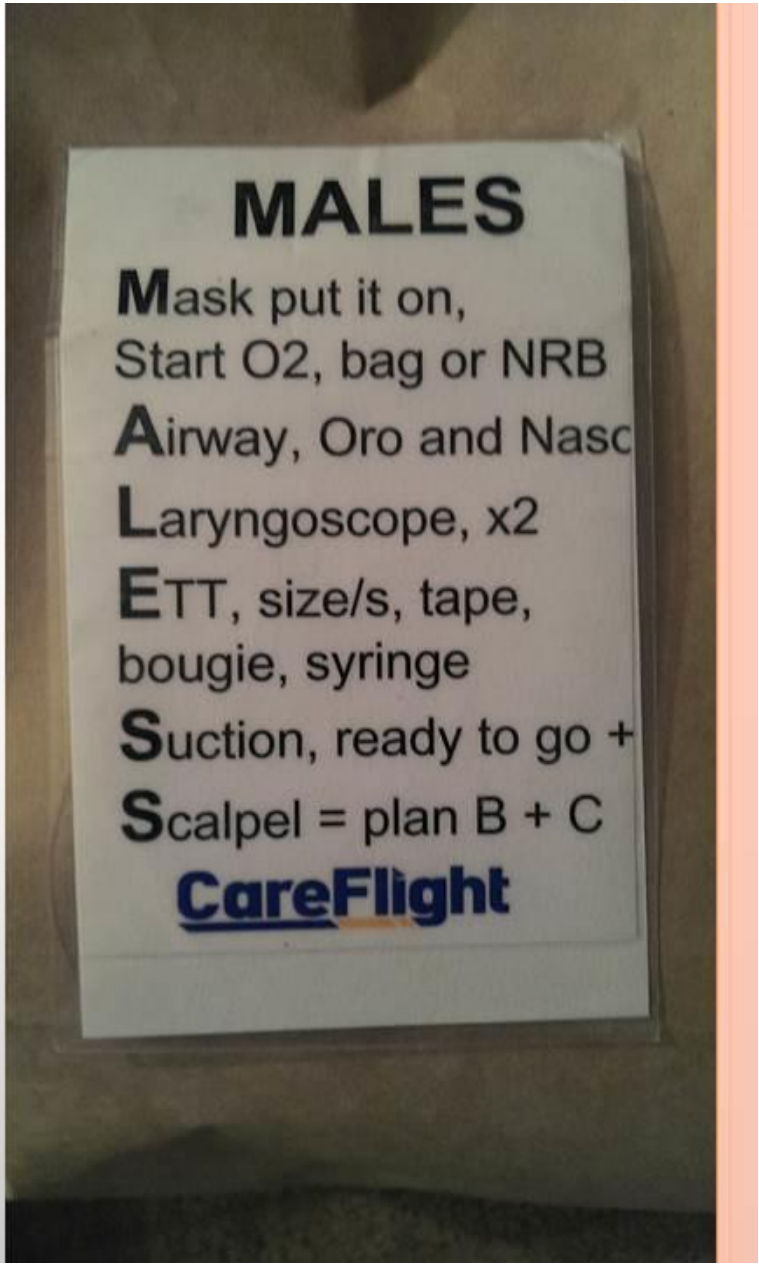
Patient position optimised	Check
O2 sufficient = 2 bottles	Check
Preoxygenation – [Nasal Prongs considered]	Check
Suction tested – [second suction considered]	Check
Monitor: ECG, NIBP, SpO2, waveform CO2	Check
IVI / Drugs	
Fluid connected, runs easily	Check
BP cuff on contralateral arm, BP seen	Check
Spare cannula in	Check
RSI drugs prepared, doses selected	Check
Intubation Equipment	
BVM	Check
OPA & 2 NPAs	Check
Laryngoscope tested	Check
Tube size chosen, cuff tested	Check
Alternate Tube	Check
Syringe	Check
Bougie	Check
Circuit: catheter mount (gooseneck), filter, capnography	Check
Tube tie	Check
Team Brief	
C-Spine immobiliser briefed – Collar open	Check
ELM / Cricoid assistant briefed	Check
Difficult laryngoscopy plan briefed	Check
LMA	Check
Crike set	Check



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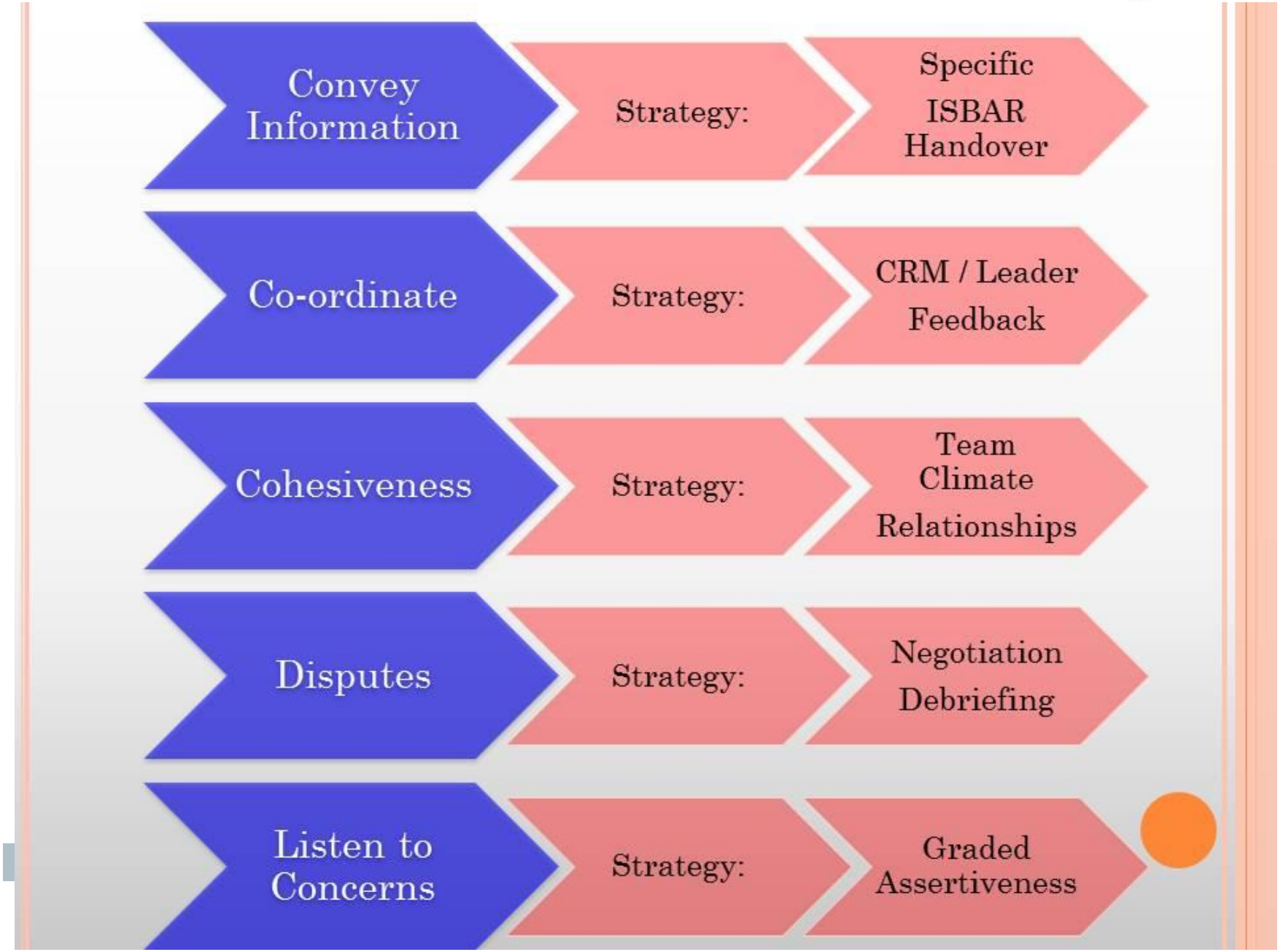

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Acute Crisis Resource Management Principles

1. Know the environment
2. Anticipate and plan
3. Call for help early
4. Exercise leadership and followership
5. Distribute the workload
6. Mobilize all available resources
7. Communicate effectively
8. Use all available information
9. Prevent and manage fixation errors
10. Cross (double) check
11. Use cognitive aids
12. Re-evaluate repeatedly
13. Use good teamwork
14. Allocate attention wisely
15. Set priorities dynamically

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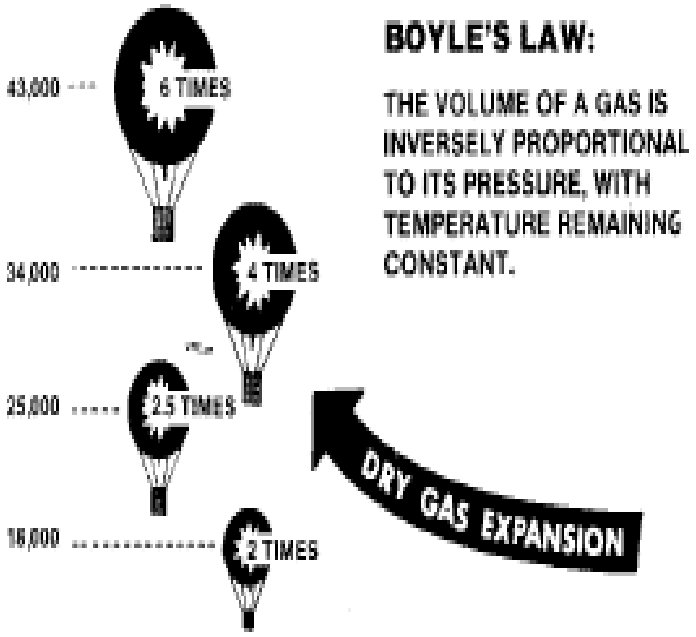


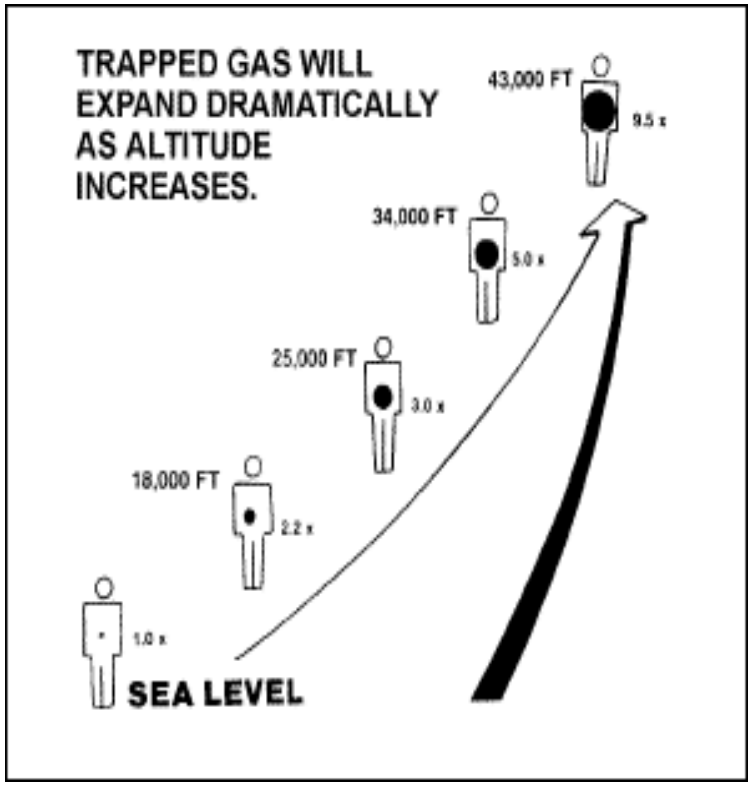
At 63,000 feet (Armstrong's Line), pressure decreases to 5% of that at sea level and the boiling point of body fluids drops to 98.6° F. Above this altitude blood will "boil" as the gases in it come out of solution. (See Henry's Law).

Dalton's Law of Partial Pressures

Dalton's Law of Partial Pressures states that *the total pressure of a gas mixture is equal to the sum of all the gases in the mixture.*

$$P_t = P_1 + P_2 + P_3 \ldots P_n$$

Altitude	Total Pressure	O_2 mm/Hg	N_2 mm/Hg	Other mm/Hg
Sea Level	760	160	593	7
10,000	523	110	408	5
18,000	379	80	296	3
25,000	282	59	221	2
34,000	190	40	148	2
48,000	95	20	74	1
63,000	47	10	37	<1



Sea level 21% = 160 mm/Hg
Partial pressure of oxygen **Total Pressure = 760 mm/Hg**

10,000 feet 21% = 110 mm/Hg
partial pressure of oxygen **Total Pressure = 522.6 mm/Hg**

Boyle's Law

Boyle's Law states that *at constant temperature the volume of gas is inversely proportional to the pressure on it.*

$\frac{V_1}{V_2} = \frac{P_2}{P_1}$ or $P_1V_1 = P_2V_2$

V_1 = the initial volume
V_2 = the final volume
P_1 = the initial pressure
P_2 = the final pressure

Relevance

Boyle's Law means that gas:

- Expands as altitude increases, because there is less pressure on it from the surrounding atmosphere.

Henry's Law

Henry's Law states that *the amount of gas dissolved in solution varies directly with the partial pressure of that gas over the solution.* Stated another way, the higher the pressure exerted on the solution, the more gas the solution will hold.

Henry's Law is well demonstrated by the example of the gases held under pressure in carbonated soda. Removing the cap exposes the liquid inside to a pressure less than what is required to hold the gas (carbon dioxide) in solution; the gas immediately begins to escape in the form of bubbles.

Henry's Law is important for air medical escorts to understand when they are transporting patients who have been diving (e.g. scuba diving, or in a hyperbaric chamber, etc.). Divers have more gas (N_2) dissolved in their blood due to the increased pressure from the water on their bodies during a dive (which can last for up to 24 hours after diving). Taking people who have been diving recently to a higher altitude releases that gas quickly, causing problems like acute decompression sickness (e.g. the "Bends").

Charles's Law

Charles's Law states that *the volume of a gas will vary directly with the absolute temperature, given that the mass and pressure remain constant.* This law is important for air medical escorts to understand because it affects the volume in air filled devices.