Helicopter Emergency Medical Service





WELCOME

- INTRODUCTION AND DISCLAIMER
- HISTORY OF HEMS IN SA
- HEMS VS FIXED WING
- FACTORS INFLUENCING HEMS AND ITS USE
- CALL OUT / FLIGHT CRITERIA / SCENE PREPARATION
- CLINICAL APPROACH TO THE PATIENT
 - GENERAL PT PREP
 - TRAUMA PT
 - MEDICAL PT
 - OBSTETRIC PT
 - NEONATAL PTS
- SUMMARY
- QUESTIONS



INTRODUCTION

- BRIAN HALSE
- OVER THREE DECADES OF BOTH PRE AND IN HOSPITAL EXPERIENCE, IN SA AND INTERNATIONALLY, IN BOTH URBAN AND RURAL AREAS, CONFLICT ZONES AND EXTREME ENVIRONMENTS, AND HAVE WORKED ON BOTH FIXED AND ROTOR WING OPERATIONS.
- DISCLOSURE:
 - EMPLOYED BY ROCKET AIR AMBULANCE AS A FLIGHT ECP & PATIENT SAFETY MANAGER



HISTORY OF HEMS IN SA

| Provider | Key Dates | Bases/Regions | Aircraft Used | Notes | |
|-----------------|--------------|---|--|--------------------------------------|--|
| Provincial HEMS | 1970s–1990s | Major hospitals nationwide | Government-leased helicopters | Early government-led operations | |
| | 1977' - 1999 | Flight for life (JHB, PTA) Aeromed (Durban) | BO105 / Bell Long Ranger | | |
| MRI | 1978–2000 | JHB, Harrismith, Durban, Cape Town | 4 helicopters (Bell long Rangers) | Ceased 2000 | |
| STAR | 1999–2005 | Gauteng, Tshwane, Polokwane, KZN, WC | Eurocopter EC-135, BO 105 LS | 24/7 service, doctor + ALS paramedic | |
| AMS/RCAMS | 2000–present | Oudtshoorn, Durban, Richards Bay, CT, Polokwane | Not specified (daylight ops) | Non-profit, limited night ops in KZN | |
| Netcare 911 | 2005–present | Gauteng, KZN, Eastern Cape, WC | EC-135, BO 105 LS, AS 350 B2, Bell 222 UT | 24/7 in Gauteng, ICU-level equipment | |
| ER24 | 2010 - 2017 | JHB, Bloemfontein, Nelspruit, NW, Pietermaritzburg | Not specified (daylight ops) | 5 helicopters, advanced medical care | |
| ROCKET HEMS | 2019–present | Independent, multiple bases | Bell 222UT / 230 | NVG, high serviceability, ICU-level | |

(Muhlbauer, 2015)

Key Operations and Aircraft Summary

Notes:

•Aircraft types evolved from single/twin-engine helicopters (e.g., EC-135, BO 105 LS, AS 350 B2) to advanced ICU-equipped Bell 222 UT/ 230/ 430 models.

•Key providers today: AMS/RCAMS, Netcare 911 and ROCKET.

•Provincial HEMS and STAR were foundational but ceased due to funding; MRI was an early private pioneer.













LAW GOVERNING HEMS IN SA

HELICOPTER EMERGENCY MEDICAL SERVICES (HEMS) OPERATIONS IN SOUTH AFRICA ARE GOVERNED BY A COMBINATION OF HEALTH AND AVIATION LAWS:

- NATIONAL HEALTH ACT, 2003 (ACT NO. 61 OF 2003): THIS ACT AND ITS REGULATIONS SET THE STANDARDS FOR EMERGENCY MEDICAL SERVICES (EMS), INCLUDING HEMS, COVERING OPERATIONAL PROTOCOLS, PERSONNEL QUALIFICATIONS, AND PATIENT CARE STANDARDS.
- EMS REGULATIONS: THESE REGULATIONS, PROMULGATED UNDER THE NATIONAL HEALTH ACT, APPLY TO BOTH PUBLIC AND PRIVATE EMS PROVIDERS AND DETAIL REQUIREMENTS FOR SERVICE OPERATION, INCLUDING AT MASS GATHERINGS.
- HEALTH PROFESSIONS ACT AND HPCSA: HEMS MEDICAL PERSONNEL MUST BE REGISTERED WITH THE HEALTH PROFESSIONS COUNCIL OF SOUTH AFRICA (HPCSA) AND COMPLY WITH ITS PROFESSIONAL AND ETHICAL STANDARDS.
- CIVIL AVIATION REGULATIONS: THE SOUTH AFRICAN CIVIL AVIATION AUTHORITY (SACAA) REGULATES ALL ASPECTS OF AVIATION, INCLUDING AIR AMBULANCE AND HEMS FLIGHTS, ENSURING AIRCRAFT, CREW, AND OPERATIONS MEET SAFETY AND LICENSING REQUIREMENTS.
- ADDITIONAL GUIDELINES: HEMS OPERATIONS MUST ALSO ADHERE TO SPECIFIC PROTOCOLS FOR
 PATIENT SELECTION AND AUTHORISATION, THOUGH THESE ARE NOT YET FULLY STANDARDISED ACROSS
 THE COUNTRY.



HEMS VS FIXED WING

| Rapid activation (<15 min) Land anywhere (LZ requirements) Limited ranges (fuel/weight) | Delayed activation (30-45min) Runway required (surfaced/dirt strip) | |
|--|---|--|
| Land anywhere (LZ requirements) Limited ranges (fuel/weight) | Runway required (surfaced/dirt strip) | |
| Limited ranges (fuel/weight) | Longor ranges | |
| •••••• | Longer langes | |
| Temp / light / VFR vs IFR | Less influenced by weather etc | |
| Weight and space restrictive | Plane dependent but generally less restrictive | |
| High noise | Buffered noise | |
| Limited working space / accessability | More working space / accessability | |
| reduced | Generally adequate | |
| Unpressurised (<8000ft) | Pressurised | |
| | Veight and space restrictive High noise Limited working space / accessability reduced Unpressurised (<8000ft) (Low & Hulme, 2017; M | |

FACTORS INFLUENCING HEMS

- COST (±R30 000-50 000/HR)
- DISTANCE (FUEL LIMITATIONS)
- WEATHER (VFR)
- LOGISTICS
 - FUEL (STRATEGIC PLANNING FOR FUEL)
 - WEATHER (PREFLIGHT AND ONGOING PLANNING)
 - DUTY HOURS (FDP)
 - LZ (UNPREPARED VS PREPARED / HAZARDS)



CALL OUT / ACTIVATION CRITERIA

- FLIGHT CRITERIA
- SPECIFIC SKILLS REQUIRED
- TAKING SPECIALIST SKILLS TO THE PATIENT (SURGEON / ALS / ECMO, ETC)
- TAKING THE PATIENT TO SPECIALIST SKILLS (SURGICAL OR OTHER / ECMO)
- RESCUE / ACCESSIBILITY ISSUES
- LACK OF SKILLS / DEPLETION OF AREA RESOURCES



CALL OUT / ACTIVATION CRITERIA

• FLIGHT CRITERIA



OOGO FLIGHT

OR 087 288 5555

Н



ROCET



FLIGHT AUTHORISATION CRITERIA

0R 087 288 5555

MEDICAL CALL-OUT CRITERIA

- HEAD INJURIES with an initial GCS of between 5 and 12 out of 15, or with focal neurological deficit
- STROKE PATIENTS where time to a stroke centre can be significantly reduced by air transport
- HYPOTENSIVE PATIENTS with a systolic blood pressure of less than 80mmHg despite attempted haemorrhage control, fluid resuscitation and or inotropic support
- **RESPIRATORY DISTRESS** despite oxygenation, where advanced airway management or mechanical ventilatory support is deemed necessary
- SUSPECTED MYOCARDIAL INFARCTION OR UNSTABLE ARRYTHMIA where time to definitive care can be significantly reduced by air transport
- NEAR DROWNING with haemodynamic compromise despite resuscitation attempts
- OBSTETRIC / NEONATAL EMERGENCIES where specialist care is not immediately available
- SUSPECTED SPINAL INJURY with or without neurological deficit, where transfer times by road are extended or terrain may prove detrimental to patient outcomes
- THREATENED LIMBS with significant vascular compromise
- **PENETRATING TRAUMA** to the head, neck, thorax and/or abdomen involving underlying organs or vascular structures
- BURNS in adults with a BSA of 20-80% or in children with a BSA of 10% or more, or burns to the face, neck and chest with potential airway compromise

REFRACTORY ANAPHYLAXIS

- ELECTROCUTION with unstable arrythmia or neurological deficit
- HYPOTHERMIA < 35°C or HYPERTHERMIA > 40°C patients requiring advanced interventions and/or management, not immediately available
- LIFE THREATENING MEDICAL CONDITIONS that require advanced interventions and/or management that is not immediately available
- ANY SIGNIFICANT MEDICAL CONDITION where the expertise of medical flight crew is likely to benefit patient outcomes

SHOULD YOU, AT ANYTIME, BE UNSURE WHETHER OR NOT A PATIENT WILL BENEFIT FROM A MEDICAL FLIGHT PLEASE DO NOT HESITATE TO ESCALATE THE MATTER TO OUR DISPATCH CENTRE, WHERE WE WILL BE HAPPY TO ASSIST



SCENE PREPARATION

• PERSONNEL

• LZ Four W's & four S's



FOR A SAFE LZ REMEMBER THE FOLLOWING. FOUR W'S AND FOUR S'S:

• FOUR W'S • WIND, WIRES, WAY IN WAY OUT.

• FOUR S'S • SIZE, SHAPE, SLOPE, SURFACE.



- AIRWAY SECURED WITH THE BEST AVAILABLE AND APPROPRIATE DEVICE (OP/NP/NIV/SGA/ETT)
 - TUBES ETC. MUST BE WELL SECURED, CUFF PRESSURES CHECKED.
 (CUFF TO BE INFLATED WITH H2O FOR FIXED WING?)

(BERNON ET AL., 2013; GILLILAND ET AL., 2015; HARDCASTLE ET AL., 2016; STEIN ET AL., 2011)

- BREATHING TARGETED (SPO2 92-95%), BVM / VENTILATED TARGETED (ETCO2 35-45cmH2O) (NB PEEP)
 - ABG/VBG
 - SEDATION/ANALGESIA



Groote Schuur Hospital, Cape Town: "Endotracheal tube cuff pressures – the worrying reality" (Bernon et al., 2013)

Findings:

High prevalence of overpressure: Mean cuff pressure in trauma centre was 55 cmH₂O, compared to 25 cmH₂O in the theatre complex. Risk in emergency settings: Only 30% of trauma centre patients had cuff pressures below 30 cmH₂O; 17% had extremely high pressures (91–120 cmH₂O)

Johannesburg Academic Hospitals: "Endotracheal tube cuff pressures in adult patients undergoing general anaesthesia" (Gilliland et al., 2015)

Findings:

Widespread overpressure: Mean ETT cuff pressure was 47.5 cmH₂O; 64.58% of patients had pressures above 30 cmH₂O. Low compliance with safe range: Only 18.75% of patients had pressures within the recommended 20–30 cmH₂O.

Inkosi Albert Luthuli Central Hospital, Durban: "Endotracheal tube cuff pressures and tube position in critically injured patients on arrival at a referral centre" (Hardcastle et al., 2016)

Findings:

Majority with excessive pressures: Only 23% of cuff pressures were within safe limits; 78% were above the recommended range. Prehospital risk: Prehospital intubations by ALS paramedics had higher rates of excessive pressures (median 70 cmH₂O) than hospital intubations (median 60 cmH₂O).

Johannesburg Emergency Care: "Assessment of safe endotracheal tube cuff pressures in emergency care – time for change?" (Stein et al., 2011)

Findings:

Inaccurate estimation: Both ALS paramedics and emergency doctors were poor at identifying safe cuff pressures using pilot balloon palpation (sensitivity 0.27).

Experience not protective: No correlation between years of experience and ability to estimate safe pressure.

SEDATION/ANALGESIA

ETT CUFF PRESSURE – ON THE GROUND







HALFWAY THROUGH ASCENT (3770FT)



CRUISING ALTITUDE (6470FT)









RESET AT CRUISING ALTITUDE (6470FT)



HALFWAY THROUGH DESCENT (3230FT)





ETT CUFF AIR – WATER EXCHANGE

- PROBLEMS ASSOCIATED WITH USING SALINE, AND WHICH INEVITABLY LED TO IT'S REMOVAL AS ROUTINE PRACTICE:
 - USING SALINE IN THE CUFF REQUIRES YOU TO DEFLATE THE ETT CUFF, POTENTIALLY CAUSING MICRO-ASPIRATION
 - IT REQUIRED THE ETT TO BE REPLACED ONCE THE PATIENT REACHES THE RECEIVING FACILITY, AS THEY WOULD NOT KEEP THE ETT WHICH HAS SALINE IN THE CUFF
 - IT IS IMPOSSIBLE TO REMOVE ALL THE AIR FROM THE CUFF, SOME WILL ALWAYS REMAIN, WHICH CAN THEN EXPAND AND INCREASE CUFF PRESSURES
 - IT IS NOT WHAT THE CUFF WAS DESIGNED TO DO, AND MANUFACTURER SPECIFICATIONS DO NOT INCLUDE USING SALINE IN THE CUFF, INCREASING RISK
 - IT DEGRADES THE CUFF OVER TIME, WHICH WAS A FINDING IN ICU AT RECEIVING FACILITIES



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 - TUBES ETC. MUST BE WELL SECURED, CUFF PRESSURES CHECKED.
 (CUFF TO BE INFLATED WITH H2O FOR FIXED WING?)

(BERNON ET AL., 2013; GILLILAND ET AL., 2015; HARDCASTLE ET AL., 2016; STEIN ET AL., 2011)

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- CIRCULATION BILATERAL LARGE BORE IV LINES, CONFIRMED PATENT, WELL SECURED AND ACCESSIBLE. (MAP >65MMHG ± & >85MMHG IN TBI)
 - START PRESSORS EARLY
 - CENTRAL LINES WELL SECURED AND PLACEMENT CONFIRMED.
 - A LINE DEPENDING ON THE TRANSDUCER MAY HAVE TO BE EXCHANGED.
 - HAVE IV SITES ACCESSIBLE
 - CHECKING PATENCY
 - INJECTION PORTS
 - HAEMORRHAGE CONTROL HAEMOSTATIC AGENTS/PRESSURE BANDAGES/ TORNIQUETS/ NPASG



- DRUGS ANY MEDICATION ADMINISTERED SHOULD BE DOCUMENTED FOR HANDOVER. ANY INFUSIONS SHOULD BE CLEARLY MARKED WITH THE CONCENTRATIONS AND THE RATE NOTED.
 - INFUSIONS- CONCENTRATION AND DOSE (DOSE/KG/MIN OR HR)
 - CLEARLY MARKED/LABLED
 - PREMEDICATION ANTIEMETIC (METOCLOPRAMIDE/ONDANSETRON/ CYCLIZINE/PROMETHAZINE)
 - ANALGESIA AND SEDATION
 - MULTIMODAL ANALGESIA
 - ADEQUATE SEDATION (RASS OR OTHER)

| Richmond Agitation and Sedation Scale (RASS) | | | | | |
|---|-------------------|---|--|--|--|
| +4 | Combative | violent, immediate danger to staff | | | |
| +3 | Very Agitated | Pulls or removes tube(s) or catheter(s); aggressive | | | |
| +2 | Agitated | Frequent non-purposeful movement, fights ventilator | | | |
| +1 | Restless | Anxious, apprehensive but movements not aggressive or vigorous | | | |
| 0 | Alert & calm | | | | |
| -1 | Drowsy | Not fully alert, but has sustained awakening to voice (eye opening & contact ≥ 10 sec) | | | |
| -2 | Light sedation | Briefly awakens to voice (eye opening & contact < 10 sec) | | | |
| -3 | Moderate sedation | Movement or eye-opening to voice (but no eye contact) | | | |
| -4 | Deep sedation | No response to voice, but movement or eye opening to physical stimulation | | | |
| -5 | Unarousable | No response to voice or physical stimulation | | | |



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ROCKET

- DRAINS -
 - IC DRAINS IN SITU IF REQUIRED. GLASS UNDERWATER DRAIN BOTTLES SHOULD BE EXCHANGED.
 - NEEDLE DECOMPRESSION IF NEEDED
 - NG / OG TUBES SECURED, AND THE BAG CLOSED
 - URINARY CATHETER SECURED AND CONFIRMED PATENT. URINE BAG CLOSED.
 - DRESSINGS CHECK FOR COVERAGE AND SEEPAGE)



- ELEVATE THE HEAD 30 DEGREES (IF POSSIBLE)
- ENVIRONMENTAL AND EXPOSURE
 - KEEP THE PATIENT WARM AND COVERED*
 - HAVE KEY AREAS EXPOSED AND ACCESSABLE, BUT COVERED TILL NEEDED
 - MAINTAIN PT DIGNITY



- FRACTURES ENSURE FRACTURES ARE SPLINTED ADEQUATELY.
 - NEW CIRCUMFERENTIAL CASTS SHOULD BE SPLIT / BACKSLABS PREFERRED
 - PELVIGRIP OR OTHER PELVIC BINDING DEVISE SHOULD BE PLACED EARLY AND NOT REMOVED.
 - SPINAL MOTION RESTRICTION MAINTAIN SMR THROUGHOUT, SCOOP STRETCHER PREFERRED (EASE OF TRANSFER WITH MINIMAL MOVEMENT)
 - VACUUM MATTRESS SHOULD BE USED FOR ALL CASES
- GET RID OF EXTRA
 - PEOPLE
 - CLOTHING/ACCESSORIES/BLANKETS*



SUMMARY

- SCARCE AND COSTLY RESOURCE
- DANGEROUS AND HAS LIMITATIONS
- WHEN USED APPROPRIATELY CLEAR BENEFITS AND IMPROVED OUTCOMES
- PATIENT PREPARATION -
 - PERSONNEL
 - LZ
 - PATIENT SPECIFIC INTERVENTIONS & PACKAGING



QUESTIONS

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