SHARING THE SKY SAFELY
11-15 November 2018  Millennium Hilton Bangkok, Thailand
Aircrew Neck Pain: An International Challenge

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Disclaimer

The opinions, interpretations, conclusions, and recommendations are those of the presenter and are not necessarily endorsed by the U.S. Army and/or the U.S. Department of Defense.

I have no conflicts of interest to report.
Neck Pain in the General Population

• 4th leading cause of disability worldwide
• Half the population has clinically important neck pain each year
• Annual prevalence varies by country – some as high as 66%
• Lots of studies
Risk Factors Associated with Neck Pain

• Previous MS pain
• High job demands
• Low social support
• Job insecurity
• Poor workstation design
• Sedentary work position
• Repetitive work
• Precision work
• Age

(and weakly…)
• Gender
• Occupation
• Headaches
• Emotional problems
• Smoking
• Awkward work postures

✓ Interactions among the above
“Tech Neck”
Neck Pain in Aviation

- Well known in fixed-wing fighter pilots
- Helicopters more known for low back pain
- 1990’s – more neck pain in RW pilots
Characteristic Patterns of Neck Pain

- Acute
- Linked to specific injurious event
- G-related

- Chronic
- Gradual onset
- Recovery between flights
Characteristic Patterns of Neck Pain

- Acute
- Linked to specific injurious event
- G-related

Both groups can develop severe chronic disease

- Chronic
- Gradual onset
- Recovery between flights
Neck Pain Patterns Blur

- More helmet-mounted equipment

Fixed Wing Fighters

- More agile helicopters

Rotary-Wing
Neck Pain in High Performance FW

• 1959 – First reported case
  • Flexion injury after +9z emergency pullout

• Well-documented in literature

• 1980’s – more frequent reports
  • Norwegian flight surgeon injury well-documented
Neck Pain in High Performance FW

- 1988 – 74% of FA-18 Navy pilots w hx
- 1989 – 50% of USAF pilots in prev 3 months
- 1997 – 84% RAAF w hx
- 2008 – 70% RAF w hx
- 2011 – 95% RAAF in past year
- 2012 – 72% Norwegian fighter pilots
- 2017 – 60% French fighter pilots
Risk Factors for Fighter Pilot Neck Pain

• F-16 – Multiple reports of increased risk 1990’s
  • 2004 – speculation that seat requires more neck muscle activation

• F-15 – Reports of increased neck problems (1995)

• MiG-29 – Associated with more neck symptoms vs MiG-23 (1999, 2008)

• 2017 – 61% CF-188 and CT-155 pilots

• 2018 – Mayes, Lindsay, Turner report ???
Chronic Neck Disease in Fighter Pilots

• Age is very strong risk factor
• Two NATO panels (1999, 2008) concluded that flying fighters has an adverse effect on c-spine
• Confirmed by one 2015 meta-analysis
• Another meta-analysis in 2015 found association only with the highest levels of G-forces
  • Authors criticized previous studies for failing to adjust for age and other risk factors
Neck Pain in FW Transport Pilots

- 1999 – 78% of E-2C Hawkeye turboprop pilots in previous year
- 2014 – USAF long-haul pilots at increased risk
  - Related to posture and vibration?
- Neck pain does not appear to be widespread
  - Could change with tactics and equipment
Neck Pain in Helicopter Pilots

- 1998 – 29% Australian 1-year prevalence
- 2006 – 57% Swedish pilots 3-month prevalence
- 2008 – 57% RAF w hx
- 2008 - ~21% Indian w sx
- 2010 – 43% Netherlands 1-year prevalence
- 2011 - 62% US Army w hx, 30% frequently
- 2004, 2016 – 80%, 75% Canadian with hx
- 2012 – 47% Israel with sx
- 2013 – 58% US Navy with significant in-flight pain
Neck Pain in RW Rear Crew

• 2008 – 71% UK rear crew w hx
• 2011 – 65% Canadian engineers w sx
• 2012 – 62% Netherlands rear crew 1-yr prevalence

• An increasing concern
Chronic Neck Disease in RW Pilots

• 2004 - RW pilots at higher risk than other pilots but age greatest factor
• 2013 – RW pilots had more degenerative changes, which correlated with flight hours
• Age continues to be strong factor
Age vs Occupational Exposure
Age vs Occupational Exposure
Neck Pain and Head-Supported Mass

• 1990s – Several studies demonstrated increased muscle work with increased helmet mass
• 2012, 2016 – EMG and computer models suggest higher risk of neck pain
• 2016 – Counterweights can increase muscle work; benefit probably task dependent
• 2006, 2011 – Multiple authors have found various correlations between NVG exposure and neck symptoms but complex
Operational Impact

• Symptoms can range from trivial to incapacitating
• Aeromedical concerns: inflight pain and reduced range of motion
• Effect of pain on performance is difficult to study
• Pain has been shown to degrade task performance, esp complex tasks and multi-tasking
Operational Impact

• 1990 – Reported case of G-related spasmodic torticollis
• 1997 – 50% F/A-18 pilots had neck pain interfere with mission completion
• 2011, 2017 – Neck pain interferes with ‘check-six’ in fighter pilots
• 2013, 2014 – Range of motion degraded in helicopter pilots with neck pain
• Common sense must prevail in absence of well-controlled studies
Conclusions

• Overwhelming weight of poorly-controlled studies in operational setting

• Flying fighter aircraft is established as risk factor for acute neck pain

• Increased head-supported mass appears to correlate with increased muscle work and patterns of neck pain

• Chronic neck disease is difficult to separate from other factors, especially age
Conclusions

• Nonetheless, neck pain is endemic in military aircrew, and solutions are needed

• Operational studies should be standardized to better understand risk factors and countermeasures
  • Survey
  • Methods
  • Pooling of data
Way Forward

• Persistent problem in aircrew led to NATO Panel 252, “Aircrew Neck Pain”
  • Presented broad range of issues at AsMA 2018
  • Another panel planned for AsMA 2019
  • Panel report due out in Feb 2019
Highlights of Recommendations

(Crowley Version)

• The Professional Athlete Model is becoming the Gold Standard for prevention of neck pain and general performance optimization in aircrew
  • Big role for physiotherapy
  • Data is needed to support

• Helmet characteristics are critical but not well-defined
  • Research is underway

• Helmet fit is more important than recognized

• Aircrew jobs should be optimized to minimize musculoskeletal stress

• Key Products to Improve Global Research:
  • Standardized survey questions
  • Standardized definitions of pain characteristics
Questions?

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