Paramedic CAT (Critically Appraised Topic)

Title: Outcomes of out-of-hospital defibrillation: manual vs. automatic defibrillators

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Clinical Scenario:
Paramedics arrive to the scene of a cardiac arrest call and witness a trained by-stander performing CPR on the patient with the use of an automated external defibrillator (AED). Should the paramedics take the time to switch the pads from the patient to use their manual defibrillator or should they continue to use the automatic defibrillator.

PICO (Population – Intervention – Comparison – Outcome) Question: Does the use of manual defibrillators vs automatic defibrillators in cardiac arrest patients lead to increased time off the chest?

Search Strategy: Medline and CINAHL databases were used. (For full search strategy, see Appendix A)

Search Outcome: 29 papers

Relevant Papers:

Author, Date	Population: Sample Characteristics	Design (LOE)	Outcomes	Results	Strengths/Weaknesses
Pytte et al. (2007)	Sixteen pairs of ambulance personnel operated the defibrillator in semi-automatic and manual modes	Randomised, cross-over manikin CPR study	Outcomes measured in this study included the pre-shock pause, the post-shock pause, hands-off ratio and number of inappropriate shocks	- Median pre-shock pause time was lower in manual compared to automatic (11s and 17ss) - The median post shock pause was much lower in manual compared to automatic (8s and 25s) - Hands off ratio was 0.3 in automatic and 0.2 in manual	<u>Weaknesses</u>: - Not a clinical study, performed in scenarios in a lab setting <u>Strengths:</u> - Simple and measured many different outcomes - shows direct comparison between manual and automatic defibrillation

				- Manual mode resulted in 12% of shocks given inappropriately and automatic resulted in 0%	
Kramer-Johansen et al. (2007)	In 223 patients in cardiac arrest, 972 shocks were delivered (472 manual and 500 automatic) to those presenting with VF/VT.	Prospective study of CPR.	Variables being measured were the pre-shock pause, the inter-shock pause and the post-shock pause. The number of inappropriate shocks was also recorded.	- Median pre-shock pause was lower in manual mode vs automatic (15s vs. 22s) - Median inter-shock pause was lower in manual vs automatic (13s vs 23s) - Median post-shock pause was lower in manual vs automatic (9s vs 20s) - Percentage of inappropriate shocks was higher for manual vs automatic (26% vs 6%)	<u>Weaknesses</u>: - Data is presented in disorganized way, tough to follow/understand results - too much data removed from study, inconsistent <u>Strengths</u>: - lots of variables measured - large enough sample size - all original data - shows direct comparison between manual and automatic defibrillation
Tomkins et al. (2013)	44 adult cardiac arrest patients presenting in a shockable rhythm, in which 203 shocks (119 manual and 84 automatic) were administered.	Prospective observational cohort.	- Shock success and ROSC were the measured outcomes - Pre-shock and post-shock pauses were also measured	- Median pre-shock pause in manual was 3s compared to 4s for automatic - Median post-shock pause in manual and automatic were both 4s - Shock success was 75.63% for manual and 70.24% for automatic	<u>Weaknesses</u>: - Too much omitted data - Study was discontinued before its completion - Small sample size <u>Strengths</u>: - shows direct comparison between manual and automatic defibrillation - original data

				- Prehospital ROSC was 18.49% for manual and 8.33% for automatic	
Berdowski et al. (2010)	110 cardiac arrest patients treated with automatic defibrillators, who presented in a shockable rhythm	Prospective cohort study.	- The primary outcome measured was survival to hospital discharge - Measured the time interval between the expected shock if the AED remained attached and the first observed shock given by the manual defibrillator	- Survival was 62% for early shocks (<20s) - Survival was 29% for delayed shocks (20-150s) -Survival was 21% if the shock was very delayed (>150s) - Concluded that ALS takeover delays the next shock delivery in almost 2/3 of cases, resulting in decreased survival	Weaknesses: - Did not compare manual vs automatic, estimated how long it would take to switch from automatic to manual - Layout was difficult to understand/follow - Makes a lot of assumptions Strengths: - Original data - Good discussion and implications

Comments:

Many excellent studies have been performed on the use of manual defibrillators and automatic defibrillators and their role in CPR. The ease of access and use of AEDs, allows for early defibrillation and helps to increase survival rates. However, manual defibrillators require training and can be difficult to use but result in successful CPR efforts more often. The studies performed by Pytte et al., Kramer Johansen et al., and Tomkins et al., all determined that the use of manual defibrillators lowers pre- and post shock pause, which is well known to increase survival rates. However, the study performed by Berdowski et al. determined that the time required by a crew to switch from the public access AEDs to their own manual defibrillators may be causing more harm.

Consider: *Why would you NOT change practice based on these articles?*
Based on these studies, I would not recommend changing practice, due to the clear superiority of manual defibrillation over automatic. It allows for much more time doing compressions, resulting in greater hospital discharge and returns of spontaneous circulation. While the study performed by Berdowski et al. shows that delaying subsequent shocks after the initial shock to switch from automatic to manual results in decreased survival, it also demonstrates that in 1/3 of the cases, the transition was made quickly enough to make the switch effective. I think the results of this study show that a change in practice is not necessary but simply better training of EMS crews in the quick transition from automatic to manual defibrillators may be essential in saving lives.

Clinical Bottom Line:
Manual defibrillators result in more effective CPR. Better training for EMS crews in the quick transition from automatic to manual defibrillators may be essential in saving lives.

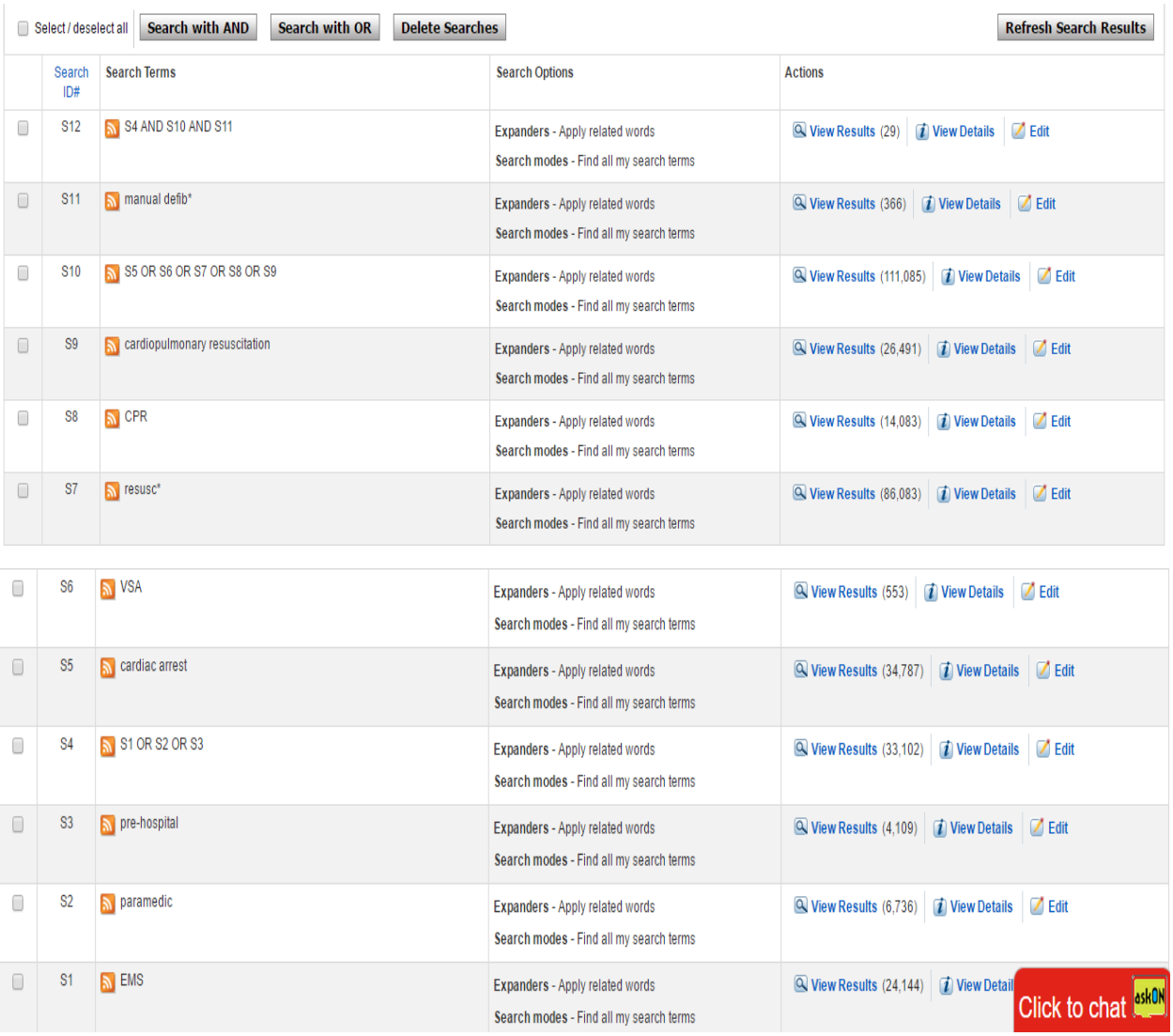
References:
Pytte, M., Pedersen, T., Ottem, J., Rokvam, A., & Sunde, K. (2007). Comparison of hands-off time during CPR with manual and semi-automatic defibrillation in a manikin model. *Resuscitation*, *73*(1), 131-136.

Kramer-Johansen, J., Edelson, D., Abella, B., Becker, L., Wik, L., & Steen, P. (2007). Pauses in chest compression and inappropriate shocks: A comparison of manual and semi-automatic defibrillation attempts. *Resuscitation*, *73*(2), 212-220.

Tomkins, W., Swain, A., Bailey, M., & Larsen, P. (2013). Beyond the pre-shock pause: the effect of prehospital defibrillation mode on CPR interruptions and return of spontaneous circulation. *Resuscitation*, *84*(5), 575-579.

Berdowski, J., Schulten, R., Tijssen, J., Alem, A., & Koster, R. (2010). Delaying a shock after takeover from the automated external defibrillator by paramedics is associated with decreased survival. *Resuscitation*, *81*(3), 287-292.

Appendix A:



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	Search ID#	Search Terms	Search Options	Actions
☐	S12	S4 AND S10 AND S11	Expanders - Apply related words Search modes - Find all my search terms	View Results (29) | View Details | Edit
☐	S11	manual defib*	Expanders - Apply related words Search modes - Find all my search terms	View Results (366) | View Details | Edit
☐	S10	S5 OR S6 OR S7 OR S8 OR S9	Expanders - Apply related words Search modes - Find all my search terms	View Results (111,085) | View Details | Edit
☐	S9	cardiopulmonary resuscitation	Expanders - Apply related words Search modes - Find all my search terms	View Results (26,491) | View Details | Edit
☐	S8	CPR	Expanders - Apply related words Search modes - Find all my search terms	View Results (14,083) | View Details | Edit
☐	S7	resusc*	Expanders - Apply related words Search modes - Find all my search terms	View Results (86,083) | View Details | Edit
☐	S6	VSA	Expanders - Apply related words Search modes - Find all my search terms	View Results (553) | View Details | Edit
☐	S5	cardiac arrest	Expanders - Apply related words Search modes - Find all my search terms	View Results (34,787) | View Details | Edit
☐	S4	S1 OR S2 OR S3	Expanders - Apply related words Search modes - Find all my search terms	View Results (33,102) | View Details | Edit
☐	S3	pre-hospital	Expanders - Apply related words Search modes - Find all my search terms	View Results (4,109) | View Details | Edit
☐	S2	paramedic	Expanders - Apply related words Search modes - Find all my search terms	View Results (6,736) | View Details | Edit
☐	S1	EMS	Expanders - Apply related words Search modes - Find all my search terms	View Results (24,144) | View Detail