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RELATIONSHIP BETWEEN TRANSTHORACIC IMPEDANCE AND BIPHASIC CURRENT REQUIRED FOR VENTRICULAR DEFIBRILLATION

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It has been commonly thought that impedance optimizes when it is minimized, since this lets the most current flow via the heart's tract. We began evaluating defibrillation efficacy of sinusoidal biphasic current in patients (n=24) with secondary ventricular fibrillation (SVF). Mostly SVF occurred in cases of cardiac failure. Duration (T) of SVF was about 0.5-7 min. Diameters of hand-held electrode paddles were 11/11 cm . The peak current (I,A), transchest impedance (TTI,Ω) and delivered energy (DE, J) were measured. Results (mean±SD and range):

TTI, Ω	**I, A**	DE, J	T,min	n
77±10	**14.5±5.3**	59±53	2.7±1.7	11
(66- 99)	**(9-26)**	(18-186)	(0.5-7.0)	
36±8.3	**22.7±4.7**	67±47	2.6±1.8	13
(22-50)	**(18-35)**	(39-197)	(0.5-7.0)	

These data show that with decrease of average TTI from 77 Ω to 36 Ω average defibrillating current increases by 57% (P<0.001) in patients with SVF. The correlation coefficient between TTI and **I** was -0.69. Perhaps pleural effusion, pulmonary edema, etc. could cause changes in TTI and shunt current around the heart decreasing its transcardiac fraction.

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TRANSTHORACIC IMPEDANCE IS INCREASED BY POSITIVE END-EXPIRATORY PRESSURE (PEEP)

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INTRODUCTION The success of defibrillation is determined by transmyocardial current. This current is inversely proportional to transthoracic impedance (TTI). We proposed that increasing end-expiratory lung volume using positive end-expiratory pressure (PEEP) would increase TTI.

METHODS 11 healthy volunteers aged 21-37 yrs (5 male, 6 female) were studied. TTI was measured between self-adhesive defibrillation pads placed in the standard antero-apical position. Measurements were taken at 30 kHz at end-expiration using Bodystat® MultiScan 5000 equipment. A standard continuous positive airways pressure (CPAP) circuit was used to generate PEEP at 2.5, 5.0, 10.0, 20.0 and 40.0 cm H_2O. Data was analysed using linear regression and paired t-tests comparing baseline TTI with that at a given PEEP.

RESULTS Mean baseline TTI was 66.2 Ω (SD±7.0Ω). TTI increased linearly with increasing PEEP (r2=0.99; P=0.0001). Percentage increases in TTI were 0.7% at 2.5 cm (P=0.03), 1.4% at 5.0 cm (P=0.0001), 2.8% at 10.0 cm (P=0.0001), 5.4% at 20.0 cm (P<0.0001) and 11.0% at 40.0 cm PEEP (P<0.0001).

CONCLUSION PEEP increases TTI in a linear fashion. Transthoracic current during defibrillation will therefore be proportionately reduced for any given energy level. Clinically, high levels of PEEP (20-40 cm H_2O) may occur during ventilation of patients at cardiac arrest and in acute asthmatics. In these situations, PEEP should either be minimised prior to defibrillation or consideration should be given to earlier use of high energy levels for defibrillation.

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A COMPARISON OF TRANSTHORACIC IMPEDANCE USING STANDARD DEFIBRILLATION PADDLES AND SELF-ADHESIVE DEFIBRILLATION PADS

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Introduction The success of defibrillation is determined by transmyocardial current. This current is inversely proportional to transthoracic impedance (TTI) which in turn is related to the electrical contact between defibrillator paddles and skin. Many defibrillators use self-adhesive defibrillation pads as an alternative to standard defibrillation paddles but differences in TTI have not been documented.

Methods TTI using defibrillation paddles was compared with self-adhesive defibrillation pads to establish which technique provided least transthoracic impedance. TTI was measured using a 30 kHz AC current in 34 adult males by medical or nursing staff trained in defibrillation. Defibrillation paddles and self-adhesive defibrillation pads were placed in the antero-apical position.

Results

	Hewlett-Packard		PhysioControl	
	Paddles(A)	Pads(B)	Paddles(C)	Pads(D)
Mean TTI (Ω)	65.4	61.9	62.6	91.9
95% CI	60.3-70.5	57.3-66.4	58.3-66.9	85.6-98.1

Conclusion Significant differences existed between all groups (P<0.05) except between B and C. Differences in TTI between A, B and C are small and probably of no clinical significance. TTI in group D is significantly larger and requires further study to determine the effects on defibrillation.

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RESULTS OF A SERIES OF TRIALS TO DETERMINE IF GLYCERAL TRINITRATE (Transdermal) OINTMENTS\ PATCHES NEED TO BE REMOVED PRIOR TO DEFIBRILLATION

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Introduction; In the mid- 1980's reports where received from the USA which led to hazard notices being issued stating that all GTN patches and ointments should be removed from a patients chest before defibrillation is carried out due to the risk of explosion from the nitro-glycerine content of the preparations. The removal of the patches or any ointment, leading to possible delays in treatment. The authors therefore conducted research with various types of patches and ointments to determine if the current patch preparations do still present such a hazard.

Method; This was achieved by passing a defibrillation current through a conductive plate equal to the chest impedance of a patient and placing patches at different distances from the paddles and under the paddles themselves to measure the reaction .

Results; The research proved that it is not the GTN content of the patch which explodes ,as reported, but rather that the foil contained in some of the patch designs which tended to act as a 'third' paddle, causing a large electrical breakthrough with a resultant 'flash'. Tests on non-metallic GTN patches proved this theory. In addition, GTN ointments did not produce any explosions or arching as reported.

Conclusions; These tests have important implications for medical patch design for the future and until all patches may be manufactured utilising plastic membranes rather than metal, the advice given during defibrillation procedures needs to be revised to include the removal of all transdermal patches rather that just those containing GTN.