EFFICIENCY OF BIPHASIC WAVEFORMS IN TRANSTHORACIC VENTRICULAR DEFIBRILLATION OF MAN. Vyacheslav A. Vostrikov, Pavel V. Holin, and Konstantin V. Razumov. CCCU, Hospital No.81 and Institute for General Reanimatology, 25 Petrovka St., Moscow, 103031, Russia.

Biphasic waveforms have been suggested as a superior waveform for defibrillation. We have begun a prospective, randomized evaluation of defibrillation (DF) efficacy of quasi-sinusoidal asymmetrical biphasic (1.0/0.4-0.6) impulses. 24 patients (pts) have received 42 shocks for ventricular fibrillation (VF). 20 pts have received these shocks for spontaneous VF; 4 pts had induced FV. Diameters of hand-held electrode paddles were 11.5-11.5 cm (21 pts) and 8-8 cm (3 pts). The operator selected an initial shock energy setting 40 or 65 joules (J). The maximum stored energy was 90 J. First phase peak current (i, A), transthoracic resistance (TTR ohms) and delivered energy (DE, J) were measured for each pulse. Results (mean±SD): rescue shocks = 25 successful DF = 100%, I = 20.5±5.0 (11-34) A; DE = 83±33 (36-185) J; TTR = 60±24 (22-117) ohms. Our clinical investigations convincingly demonstrated great efficacy of biphasic impulses for transthoracic defibrillation.

DEFIBRILLATION USING A SERIES OF SHOCKS TIMED TO THE FIBRILLATION CYCLE LENGTH. Robert J. Sweeney, Robert M.Gill, and Philip R. Reid. Eli Lilly and Company, Indianapolis, IN 46285.

Two shocks can be combined to defibrillate with reduced current if they are separated by 85% of the fibrillation cycle length (FCL). In this study we extended this method to three-shock and four-shock series. In open-chest pentobarbital-anesthetized dogs, we measured DFTs for series of 8 msec rectangular shocks. Group 1 used a three-shock series with 85% then 30% to 160% separations. Group 2 used a three-shock series with 75%, 85%, or 95% separation for the first two shocks, then a 100% to 130% separation. Group 3 used a four-shock series with a 95%:120% separation for the first three shocks then a 75% to 180% separation for the fourth. Data (mean±SD) are normalized by the single shock strengths.

Group	Separations	Current	Energy
2-shock	(85%)	0.83±0.18	1.39±0.43
best 3-shock	(85%:105%)	0.71±0.06	1.46±0.24
best 3-shock	(95%:120%)	0.67±0.09	1.34±0.24
best 4-shock	(95%:120%:130%)	0.79±0.15	2.48±0.79

These data show that the method of timing multiple shocks to the FCL can be readily extended to a three-shock series to further reduce defibrillation current with only moderate increase in total energy, but that adding a fourth shock to the series greatly decreased defibrillation efficacy. Also, the optimum separation was longer for each additional shock in the series suggesting that the shocks were altering the fibrillation event. These findings may be useful in the development of future "smart" defibrillators that distribute the defibrillation process over time.

• VI ICD ELECTRODES

IS AN INTERNAL CARDIOVERTER DEFIBRILLATOR STILL NEEDED IN PATIENTS WHOSE SUSTAINED MONOMORPHIC VENTRICULAR TACHYCARDIA BECOMES NON-INDUCIBLE AFTER CORONARY ARTERY BYPASS GRAFTING SURGERY? William H. Kou and Marvin Kirsh. University of Michigan and VA Medical Centers, 2215 Fuller Road, Ann Arbor, MI 48105.

Sustained monomorphic ventricular tachycardia (SMVT) may become non-inducible (NI) following coronary artery bypass grafting surgery (CABG). However, the risk of subsequent sudden cardiac death (SCD) in these patients (pts) remains unclear. Between 1987 and 1993, 12 consecutive pts who had inducible SMVT (cycle length 265±56 msec, mean±SD) underwent CABG and were studied prospectively with a pre- and post-CABG electrophysiology study (EPS) using a similar stimulation protocol (2 right ventricular pacing sites, 2 basic drive cycle lengths, 3 extra stimuli and isoproterenol challenge). EPS on post-CABG day 12±6 showed that the SMVT became NI in 8 pts. These 8 pts were followed to determine their SCD survival. Their age was 61±9 yrs. The original presentation was a SCD survivor in 3 and syncope or presyncope in 5 pts. They had previously failed 1.6±0.9 antiarrhythmic trials. During CABG (3±1 grafts), only internal cardioverter defibrillator (ICD) electrodes were placed. No antiarrhythmic was prescribed during follow-up. During a follow-up period of 24±22 months, 2 pts died of SCD; one died in 2 weeks and the other in 14 months. There was not difference in age, left ventricular function, history of myocardial infarction, original presentation between those who did and did not die of SCD. Conclusions: Despite of non-inducibility of SMVT following CABG, these pts continue to be at risk of SCD. Therefore, they should be treated with an ICD following CABG.

DECREASED DEFIBRILLATION THRESHOLD WITH A NEW EPICARDIAL CARBON ELECTRODE COMPARED TO A STANDARD TITANIUM PATCH. Parwis C. Fotuhi, Eckhard U. Alt*, Richard L. Callihan, Dennis L. Rollins, Edgar Mestre*, William M. Smith, Raymond E. Ideker. Box 3140, Duke University Medical Center, Durham, NC 27710, USA and * the I. Med Klinik, Technische Universitat Munchen, Germany.

Due to high defibrillation thresholds, 10% to 15% of patients cannot be treated with endocardial leads alone and receive epicardial patch based systems. The aim of this study was to compare an epicardial braided carbon electrode of 7 french diameter and 14 cm length with a 14 cm^2 left ventricular epicardial titanium mesh patch (CPI Inc., St. Paul, MN) each in combination with a CPI lead, a Medtronic lead or a carbon-platinum-iridium prototype cathode. Eight dogs underwent defibrillation threshold determination (DFT) with the 6 electrode configurations using a 3.2/2 biphasic waveform 10 sec after ventricular fibrillation was initiated. The mean DFT energy decreased with the epicardial carbon electrode between 36% and 53% and voltage between 24% and 35% compared to the titanium patch: from 8.±2.5 J to 4.9±3.6 J with the CPI lead, from 6.2±2.5 J to 2.9±2.1 J with the prototype and from 6.4±3.4 J to 3.5±2.6 J with the Medtronic lead ($p \leq 0.05$). This positive impact is probably due to less disturbance of the potential gradient field by the carbon wire and to the larger area described with the wire.