EXTRACTION OF PERMANENT PACEMAKER LEADS USING THE COOK EXTRACTION SET; INITIAL CLINICAL EXPERIENCE

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During a 5 month period a total of 15 permanent pacemaker leads were extracted from 10 patients. The leads extracted were of varied construction and were produced by several manufacturers. Leads removed included 9 unipolar, 4 bipolar, and 2 bipolar coaxial. Insulation was silicone in 13, polyurethane in 2. The fixation devices were of active and passive types: 6 screw-in, 3 tined, 4 finned, 1 flanged, 1 tined and flanged. Five leads were atrial and 10 ventricular. The mean duration of implant was 41 months ± 34 (range 12-108). The left subclavian approach was used in 8 cases, right subclavian in 6, and right supra-clavicular in 1. An initial attempt was made to remove each lead by traction and rotation. Two leads (both atrial screw-in) were extracted in this way. The remainder required use of Cook Extraction devices. The technique involves placing a locking stylet into the lead and then sliding a plastic sheath over the lead to the electrode to clear away epithelial tissue and to apply counter-traction to the myocardium. Twelve of the remaining 13 leads (92.3%) were removed in this fashion. One lead could not be extracted beyond the clavicle and was partially retained. There were no complications. This technique is effective and safe for permanent pacemaker lead extraction.

The Effect of Rapid Pacing Rates On The Human Atrial Strength Duration Relation.

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It has been demonstrated that the strength-duration curve is defined by two values, rheobase (R), the least stimulus voltage that results in atrial excitation, and chronaxie (C), the threshold pulse duration at twice rheobase voltage. The threshold stimulus energy is minimized at the chronaxie pulse duration. However, the effect of rapid pacing rates on the atrial strength-duration relation has not been examined in humans. Rheobase, chronaxie, minimal threshold energy, and atrial effective (ERP) and functional (FRP) refractory periods were determined during constant voltage pacing using a low polarization, high current density unipolar electrode (Medtronic 4511) positioned in the right atrial appendage at rates of 125, 150, 175, 200, 225, 250, 275 and 300 bpm in 10 patients. No patient had evidence of sinus node dysfunction or atrial arrhythmias. The mean rheobase and chronaxie values at each pacing rate were:
125 bpm R=0.62 V, C=0.195 ms; 150 bpm R=0.62 V, C=0.195 ms, 175 bpm R=0.67 V, C=0.235 ms; 200 bpm R=0.71 V, C=0.265 ms; 225 bpm R=0.74 V, C=0.34 ms; 250 bpm R=1.14 V, C=0.36 ms; 275 bpm R=1.66 V, C=0.47 ms; 300 bpm R=2.44 V, C=0.58 ms.

The rheobase voltage exceeded 5 V at pacing rates greater than 250 bpm in 3 patients. By analysis of variance, R ($p=0.009$), C ($p=0.001$), and Energy ($p=0.05$) increased significantly with rate. There was a significant correlation between the atrial ERP and rheobase voltage at rates greater than 250 bpm ($r=0.81$, $p=0.01$).
Conclusion: There is an upward displacement of the atrial strength duration curve at rates exceeding 250 bpm, probably related to enchroachment on the relative refractory period of the atrial myocardium. These findings have important implications for atrial antitachycardia pacing requiring rates over 250 bpm.

USE OF LOCKING STYLETS AS PART OF A TRANSVENOUS APPROACH FOR EXTRACTION OF CHRONIC PACING LEADS

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To reduce morbidity and risks of lead removals, the use of locking stylets as part of a transvenous approach for extracting chronic leads was investigated. Indications for removal of 39 leads implanted 5 days to 168 months (mean 48 months) in 19 patients included septicemia, infection, pre-erosion, lead trapped in valve, and prophylaxis against complications of numerous leads. Sixteen leads were atrial, 23 were ventricular; 24 were polyurethane, 14 were silicone, 1 was poly/silicone. Fixation mechanisms included tines or fins (26), helix (11) and flange (2). For 25 leads accessible through the subclavian or cephalic vein, a special sized stylet with an expandable locking mechanism was inserted into the coil lumen and locked at the tip, permitting retraction without lead extension. Maintaining tension on the locked stylet, telescoping sheaths were advanced over the lead to detach and dilate scar tissue encasing the lead and, within the heart, to localize retraction force preventing myocardial invagination. Five of 11 active fixation leads, 1 tined lead implanted 2 months, and the lead entrapped in the valve were removed without using a stylet. For 2 leads implanted 70 months, the stylet could not be inserted and a suture was tied to the lead to maintain tension while advancing sheaths; the atrial silicone lead was removed intact, but the ventricular polyurethane lead broke at the tip and the electrode remains embedded. For 4 leads inaccessible via the subclavian and 1 lead for which scar tissue prevented sheath advancement, a femoral approach using a deflection catheter and a Dotter snare advanced through flexible sheaths was necessary.
Conclusion: Using the transvenous retrieval techniques, 38 leads were completely removed and 1 removed except for the tip. Use of the locking stylet when possible facilitated lead removal by reinforcing the lead and providing a guide for dilator sheaths to follow.

REVERSIBLE AND IRREVERSIBLE EFFECTS OF IONIZING RADIATION ON MODERN PACEMAKERS.

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To assess the risk of pacemaker (PM) malfunction (M) and its development over time 17 modern PM of various types were irradiated with a Co-60 source (9/17) or a linear accelerator (8/17). The radiation exposure was fractionated over 3 weeks up to a total dose of 10 Gy (phase I). Afterwards (phase II), 2 single applications of 5 Gy or 10 Gy were made. The continuous monitoring and documentation of frequency(Fr), pulse width and amplitude was carried out via microprocessor-controlled circuit. Telemetry (Te) and programmability (Pr) were checked manually.

Results:

	phase I (n=17)		phase II (n=17)	
	RM*	IrM°	RM*	IrM°
Fr	1 (2.4Gy)			
Te		1 (6.4Gy)		
Pr	1 (2.4Gy)	1 (6.4Gy)		1 (25Gy)
Compl. failure		1 (9.2Gy)	3 (25Gy)	

*RM = reversible M °IrM = irreversible M

The occurrence of M, its latency and regression varied over periods of minutes to a maximum of two weeks.

Conclusions: According to these results PM-dependent patients should be prophylactically provided with an external PM when a dose of scattered radiation is to be expected at the level investigated.