Surgical treatment of atrial fibrillation using radiofrequency ablation
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Atrial fibrillation (AF) is not an acute but an insidious disease. It is associated with a 1.5 to 2.0 fold increase of mortality and a 2 to 5 fold increase for stroke in patients with a cardiovascular disease (1, 2, 3). AF is related to 15% of all strokes. In addition to that, AF related strokes tend to be more fatal than the non-AF related strokes with a 30-day mortality of 25% versus 14% for the non-AF related strokes (4). Moreover, recurrences of strokes were more frequent and functional deficits were more likely to be severe in survivors. As a consequence, the health care costs will increase. Reports revealed that the medicare spending increased between 8.6% to 22.6% per year due to AF treatment (5). The estimated prevalence of AF, in the USA, is 2.3 million people. The projected number of patients, in 2050, will be 5.6 million (range 5.0- 6.3). The prevalence of AF increases with age; 0.1% under 65 years to 9% over 80 years (6). So, the clinical importance of AF and the necessity to treat AF has gained wide spread recognition. The efficacy of the pharmacological therapy to convert AF into a stable SR is low. Even after electrical cardioversion (CV) with 100-200 Joule, the SR conversion rate was 86% after three days, 23% after 1 year and 16% after 2 years. In persistent AF the 4 year-arrhythmia free survival was less than 10% after single electrical CV without prophylactic drug therapy. If a second consecutive electrical CV was combined with medical therapy a SR conversion rate of 40% after 1 year and 33% after 2 year was anticipated. However, all types of drug therapy are associated with proarrhythmic side effects, especially torsade des pointes adversely affecting the SR conversion rate (7). So, non-medical therapy modalities have emerged, such as “the cut and sew” Cox-Maze III surgical procedure, which consists of a well-defined pattern of left and right atrial incisions in order to interrupt the multiple wavelet macro reentry circuits, eliminating AF. The reported SR conversion rate after the Cox-Maze III procedure is 97-99% and is therefore considered the golden standard (8). But, the complexity of the “cut and sew” Cox-Maze III technique is considered a drawback. Therefore, this procedure is not universally accepted as a standard practice in the surgical treatment of AF. As a consequence, alternative sources of energy (radiofrequency-, microwave-, cryoablation) have emerged to surgically treat AF. But the efficacy of the alternative energy sources is debated, because the creation of continuous linear transmural lesions, which act as an electrophysiological conduction block, is considered to be uncertain and inconsistent. This thesis describes our experience in the Haga Hospital The Hague, The Netherlands and in the Bergbau Berufsgenossenschaftliche Kliniken Bergmannsheil University Hospital Bochum Germany, with the saline-irrigated, cooled- tip radiofrequency ablation (SICTRA) to treat AF. SICTRA is performed with a cooled porous radiofrequency ablation catheter, which was originally used by Wittkampf and colleagues (9). The employment of such a catheter impedes an impedance upstroke because the electrode-tissue surface temperature will drop due to the continuous saline irrigation. Therefore, the total amount of radiofrequency energy, which can be delivered, will be higher and consequently a deeper tissue lesion can be created (10). Sie and colleagues proposed the intraoperative use of irrigated radiofrequency ablation to treat patients with AF (11). So, SICTRA enables a better option to produce intra atrial transmural lesions.

Aims of the thesis:
1. To assess the reproducibility of the reported SR conversion rate of 97-99% for the “cut and sew technique” Cox-Maze III procedure.
2. To evaluate the efficacies of the alternative sources of energy (radiofrequency-microwave and cryo ablation) compared to the classical “cut and sew” Cox-Maze III.

3. To assess the efficacy, expressed as the postoperative SR conversion rate, of the saline-irrigated-cooled-tip-radiofrequency-ablation (SICTRA) to eliminate AF by creating intra-atrial linear lesions, which act as electrophysiological barriers.

4. To evaluate the safety, expressed as the risk of collateral damage of mediastinal structures such as esophageal- and circumflex injuries as well as RF perforations or bleedings using SICTRA.

5. To evaluate the efficacy of the left atrial lesion pattern compared to the bi-atrial lesion pattern to eliminate AF.

6. To evaluate the SR conversion rate of an anti-arrhythmia procedure in non-mitral valve surgery compared to mitral valve surgery.

7. To assess the efficacy of a concomitant anti-arrhythmic procedure in CABG patients with permanent AF.

8. To assess the efficacy of a concomitant anti-arrhythmic procedure in high-risk more morbid and sicker patients who underwent combined valve(s) and CABG surgery.

9. To examine the pathomorphological alterations induced by RF ablation in human atrial tissue.

10. To describe a surgical technique which minimizes the risk of damaging the adjacent cardiac structures.

11. To evaluate the efficacy of the anti-arrhythmic postoperative medication and the value of electrical cardioversion.
References