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S-ICD CLINICAL REPORT 11

S-ICD: PROVEN PERFORMANCE IN ALL AGE GROUPS

This clinical report explores the latest clinical data on subcutaneous implantable cardioverter-defibrillator (S-ICD) performance *versus* transvenous-ICD (TV-ICD) in patients of all ages. Three individual studies are reviewed. The ATLAS randomised clinical trial demonstrates the superiority of S-ICD over TV-ICD in reducing serious lead-related complications in adult recipients 6 months after implantation.[1] A large US representative study compares mid-term outcomes in older recipients of S- and TV-ICD.[2] Finally, we discuss the results of the first study assessing patients' acceptance of S-ICD using the Florida Patient Acceptance Survey.[3]

1. Avoid Transvenous Leads in Appropriate Subjects (ATLAS) trial: A superiority trial in adults

The ATLAS clinical trial is a randomised, prospective, controlled head-to-head study in adult patients (Figure 1), results of which have been presented as Late-Breaking Clinical Trials at Heart Rhythm Society 2022 Congress.[1]

Eligible patients were aged 18–60 years and had a standard ICD indication, or ≥18 years with any of the following: inherited arrhythmia syndrome; prior pacemaker or ICD removal for infection; the need for haemodialysis; prior heart valve surgery; or chronic obstructive pulmonary disease.[1]

The primary endpoint was to determine whether using S-ICD reduces the rate of serious lead-related complications 6 months after implantation compared with TV-ICD.[1]

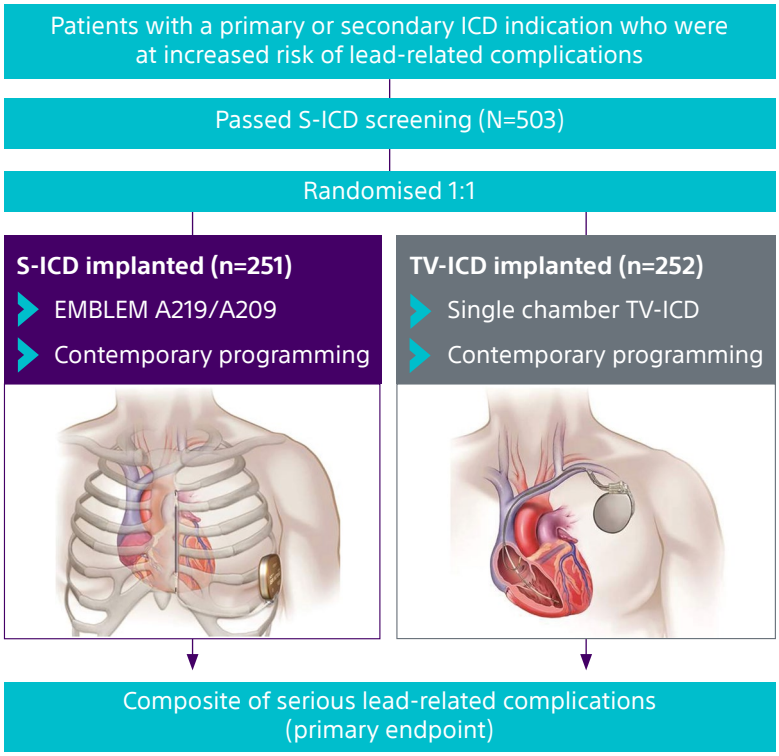
Primary endpoint: S-ICD superiority over TV-ICD

S-ICD was superior to TV-ICD in preventing serious lead-related complications, with a 92% complication reduction 6 months after implant and only 1 case of pericarditis unrelated to S-ICD reported compared with 12 events for TV-ICD (0.4% *versus* 4.8%, p=0.003) (Table 1 and Figure 2).[1]

These findings build upon previous results from the PRAETORIAN trial, which also reported a 79% reduction in lead-related complications in the S-ICD group compared with TV-ICD (1.4% *versus* 6.6%, p=0.001) and showed that S-ICD was non-inferior to TV-ICD regarding ICD-related adverse events over 4 years.[4]

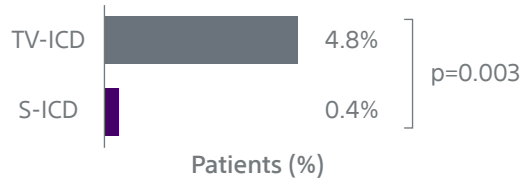
92% **reduction** in serious lead-related complications in patients with S-ICD implantation, compared with TV-ICD.[1]

Figure 1. ATLAS: 6-month study overview.[1]



The ATLAS trial is an investigator-sponsored research study initiated, designed and led by the Population Health Research Institute, conducted across 14 Canadian centres.
ICD, implantable cardioverter-defibrillator; S-ICD, subcutaneous implantable cardioverter-defibrillator; TV-ICD, transvenous implantable cardioverter-defibrillator.

Figure 2. Fewer serious lead-related complications with S-ICD after 6 months (primary composite endpoint).[1]



S-ICD, subcutaneous implantable cardioverter-defibrillator; TV-ICD, transvenous implantable cardioverter-defibrillator.

Table 1. Primary endpoint.[1]

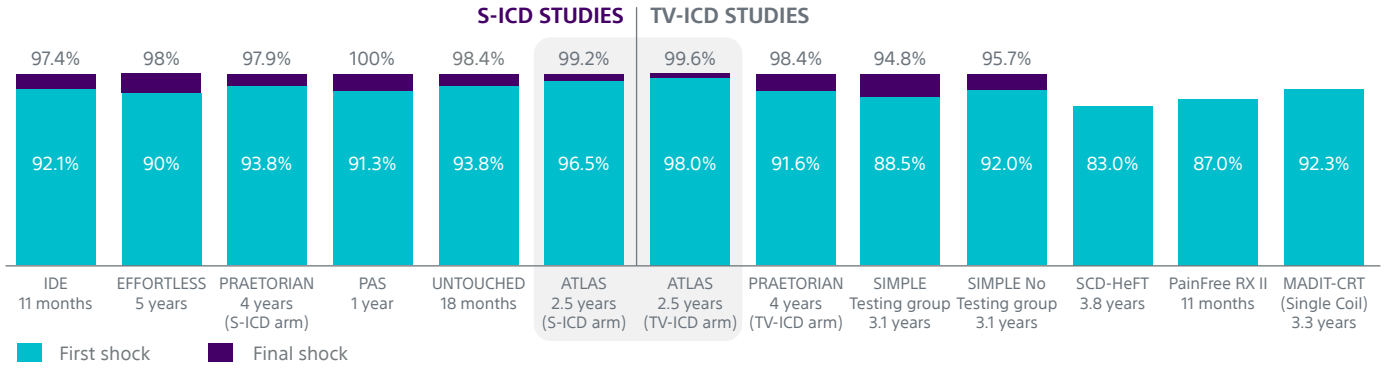
	S-ICD	TV-ICD	Odds ratio (CI)	p value
Composite primary endpoint, n (%)	1 (0.4)*	12 (4.8)	0.08 (0.00–0.55)	0.003
Haemothorax/pneumothorax, n (%)	0	2 (0.8)	0.41 (0.00–3.48)	0.25
Cardiac perforation, tamponade, pericardial effusion or pericarditis, n (%)	1 (0.4)*	4 (1.6)	0.25 (0.01–2.54)	0.38
Lead dislodgement or loss of pacing/sensing requiring revision, n (%)	0	2 (0.8)	0.41 (0.00–3.48)	0.25
New moderate-severe or severe tricuspid insufficiency (3+ or 4+), n (%)	0	3 (1.2)	0.26 (0.00–1.72)	0.13
Ipsilateral upper extremity deep venous thrombosis, n (%)	0	1 (0.4)	1 (0.00–19.08)	0.50

*Pericarditis unrelated to S-ICD.
CI, confidence interval; S-ICD, subcutaneous implantable cardioverter-defibrillator; TV-ICD, transvenous implantable cardioverter-defibrillator.

Selected secondary endpoints: S-ICD efficacy comparable to TV-ICD

During a mean follow-up of 2.5 years, both S-ICD and TV-ICD groups had >99% spontaneous shock conversion efficacy (Figure 3), consistent with that observed in other S-ICD clinical studies, across a diverse range of patients.[5-14]

Figure 3. S-ICD spontaneous shock efficacy of 98–100% was demonstrated in 4,730 patients across six randomised studies and registries up to 5 years post implant.[5-14]



S-ICD, subcutaneous implantable cardioverter defibrillator; TV-ICD, transvenous implantable cardioverter-defibrillator.

2. Large representative US national comparative analysis in older patients after S-ICD or TV-ICD implantation

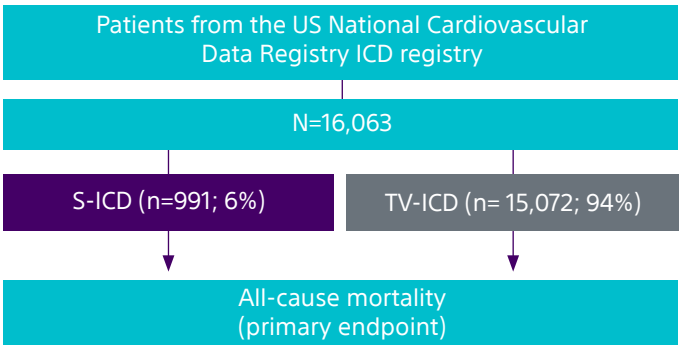
This was a large, multicentre registry of Medicare patients ≥65 years from the National Cardiovascular Data ICD Registry, which captured approximately 90% of all ICD implantations in the US during the study period (Figure 4). The study aimed to compare outcomes among patients who received an S-ICD or TV-ICD after a median follow-up of 2.3 years after implantation.[2]

Favourable outcomes in older patients

The risks of all-cause mortality, device removal for infection, device reoperation without infection, cardiovascular readmission and recurrent all-cause readmission were similar between the S-ICD and TV-ICD groups (Figure 5).[2]

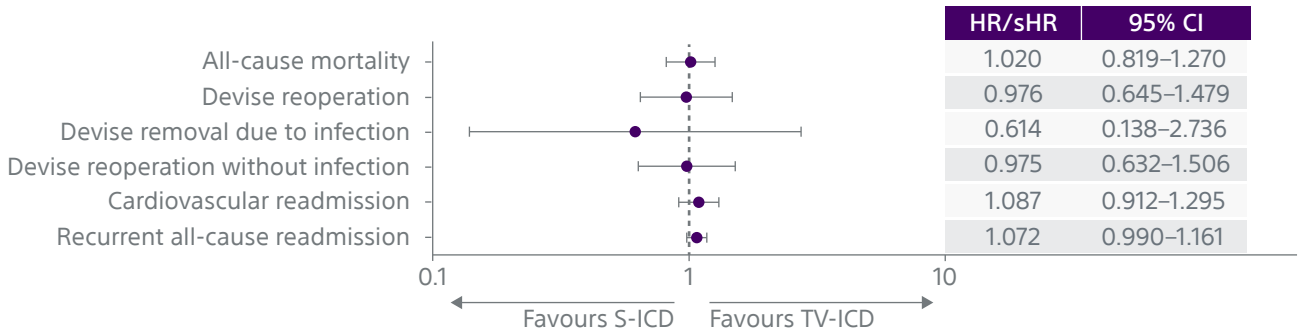
These data are consistent with those of the PRAETORIAN trial (and published meta-analyses) and extend the conclusions to older individuals (the mean age of patients in this National US registry was 72.7 ± 5.8 years).[2,4,15]

Figure 4. US representative study of midterm outcomes in patients ≥65 years.[2]



Patients underwent implantation between 28 September 2012 and 31 December 2017.
Mean age was 72.6 (±5.9) years.
ICD, implantable cardioverter-defibrillator; S-ICD, subcutaneous implantable cardioverter-defibrillator; TV-ICD, transvenous implantable cardioverter-defibrillator.

Figure 5. Similar risks of all-cause mortality, device reoperation or removal, and cardiovascular and all-cause readmission.[2]



	HR/sHR	95% CI
All-cause mortality	1.020	0.819–1.270
Devise reoperation	0.976	0.645–1.479
Devise removal due to infection	0.614	0.138–2.736
Devise reoperation without infection	0.975	0.632–1.506
Cardiovascular readmission	1.087	0.912–1.295
Recurrent all-cause readmission	1.072	0.990–1.161

CI, confidence interval; HR, hazard ratio; sHR, subdistribution HR; S-ICD, subcutaneous implantable cardioverter defibrillator; TV-ICD, transvenous implantable cardioverter defibrillator.

3. A multi-centre experience on patient acceptance of S-ICD *versus* TV-ICD

Patients from the Italian RHYTHM DETECT registry were enrolled to evaluate their acceptance of the S-ICD and its association with clinical and implantation variables. Patient acceptance was calculated with the Florida Patient Acceptance Survey (FPAS), which measures four factors:[3]

- Return-to-function (RTF)
- Device-related distress (DRD)
- Positive appraisal (PA)
- Body image concerns (BIC)

The study included 176 patients that had consecutively undergone S-ICD implantation across 17 centres; 57% (n=101) had heart failure and reduced Ejection Fraction (HFrEF). Patients with HFrEF implanted with S-ICD were compared with a control group of 101 patients with HFrEF implanted with TV-ICD.[3]

Positive acceptance of S-ICD in patients at risk of more distress

Good acceptance of S-ICD by patients was reported 12 months after implantation, including by those at higher risk of distress, such as women (FPAS score of 71),young patients (FPAS score of 78) or those with thinner body habitus (FPAS score of 80). The total FPAS score and each of the four factor scores did not significantly differ according to gender and body habitus, while patients <65 years showed significantly higher RTF scores compared with those ≥65 years (median 75 *versus* 56, p=0.029) but no significant difference in the other scores (Table 2).[3] Patients with HFrEF implanted with S-ICD had significantly lower total FPAS and RTF scores than those without HFrEF (median 72 *versus* 80, p=0.030, and 69 *versus* 81, p=0.038, respectively).

Similar total FPAS and RFT scores were observed between patients with HFrEF implanted with S-ICD and TV-ICD (median 72 *versus* 75; p=0.270, and 69 *versus* 72 *versus*; p=0.890, respectively).[3] However, patients implanted with S-ICD exhibited significantly better PA than those implanted with TV-ICD (median 88 *versus* 81; p=0.017)[3] suggesting a greater acceptance for this kind of device in these patients with greater morbidity.

Table 2. Median values (with 25–75 percentile) of FPAS measures by age, gender and BMI.[3]

Measure	RTF	DRD	PA	BIC	FPAS
Age <65 years (n=151)	75 (56–94)	25 (10–50)	94 (75–100)	0 (0–38)	78 (58–87)
Age ≥65 years (n=25)	56 (50–81)	20 (15–40)	888 (75–100)	13 (0–50)	68 (61–83)
p value	0.029	0.840	0.674	0.267	0.470
Male (n=139)	75 (50–94)	25 (10–50)	88 (75–100)	13 (0–50)	77 (58–87)
Female (n=37)	75 (56–94)	25 (20–55)	88 (69-100)	25 (0–63)	71 (58–84)
p value	0.804	0.457	0.619	0.259	0.518
BMI ≤25 (n=81)	75 (56–94)	20 (10–35)	88 (75–100)	25 (0–38)	80 (63–87)
BMI >25 (n=95)	75 (50–94)	30 (15–60)	94 (81–100)	13 (0–50)	75 (56–88)
p value	0.836	0.114	0.108	0.451	0.593

BIC, body image concerns; BMI, body mass index; DRD, device-related distress; FPAS, Florida Patient Acceptance Survey; PA, positive appraisal; RTF, return-to-function.

Summary

- Data from the ATLAS study show superiority of S-ICD over TV-ICD in reducing the rate of serious lead-related complications 6 months after implantation in adult patients, with a conversion efficacy of over 99% during spontaneous episodes at 2.5 years.[1]
- Data from a large US registry in older patients confirm no significant differences between ICD types in mortality, device reoperation or removal, and cardiovascular or all-cause readmissions.[2]
- S-ICD is well accepted, even in patient subgroups more prone to psychological distress about the procedure, such as women, younger patients and those with thinner body habitus. In addition, in patients with HFrEF, patients implanted with S-ICD showed better PA compared with those with TV-ICD.[3]

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