ABSTRACT. The transformer of an implantable cardioverter-defibrillator (ICD) multiplies the low energy from the battery (~3 V) to the high voltage of a shock (~800 V). Transformer malfunction during high-voltage charging (automatic capacitor reform) can cause circuitry damage and loss of therapy. Here we report the first US case of a transformer break with loss of shock therapy and battery depletion in the Boston Scientific INCEPTA ICD.

KEYWORDS. battery depletion, internal cardioverter defibrillator, shock therapy, transformer failure.

Case presentation
The patient was a 62-year-old woman with a history of non-ischemic cardiomyopathy (left ventricular ejection fraction 30%, New York heart Association class II) s/p INCEPTA single-chamber ICD implantation for primary prevention. The device was functioning normally with stable parameters at 1- and 4-month follow-up.

At 7-month follow-up, the device could not be interrogated despite attempts using multiple programmers. Fluoroscopic inspection of the system was normal. An ICD generator change was performed.

Returned product testing by the manufacturer confirmed that the transformer’s secondary wires were fractured and damage had been sustained to the power supply circuitry due to electrical overstress. Examination of the primary and secondary windings found damage of the secondary windings consistent with arcing between adjacent wires (Figure 1). Collateral damage to the associated power supply circuitry rendered the device inoperable, and likely created a high-current condition with rapid depletion of the device’s battery. Because this type of failure occurs during high-energy charging and based on the absence of any reported patient symptoms, it was concluded that the transformer malfunction likely occurred during an automatic capacitor reformation.

Commentary
A low rate of transformer malfunction has been previously reported in COGNIS and TELIGEN defibrillators (26 out of 233,000 or 1 out of every 8,900 devices). An unrelated design change was implemented in the INCEPTA family. Four of the outer, primary windings were removed to avoid inductive telemetry interference during charging, but it is not yet clear if the rate of transformer malfunction has been altered. This is the first reported case in the United States demonstrating that transformer breaks with loss of shock therapy and rapid battery depletion can occur despite the executed design changes in the INCEPTA family.
Figure 1: (a, b) Arcing damage of the secondary windings. (b) A close-up view of the secondary windings in (a) (magnification 10–20×).