The Impact of Immediate Salvage Surgery on Corporeal Length Preservation in Patients Presenting with Penile Implant Infections

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Purpose: Removal of an infected penile implant often results in corporeal fibrosis, irreversible penile shortening and dissatisfaction with future implant surgery. Salvage surgery may avoid these problems but to our knowledge no study to date has evaluated these specific end points. We evaluated patients who presented to our center with an infected implant to determine the impact of salvage surgery on penile length.

Materials and Methods: We evaluated consecutive patients undergoing removal of an infected penile prosthesis with immediate salvage or delayed reimplantation using a comprehensive, prospective database. Total corporeal length prior to and following immediate salvage or delayed reimplantation were compared. The impact of patient age, comorbidities, bacterial species, initial penile length and time to reimplantation on subsequent total corporeal length was evaluated.

Results: The cohort consisted of 40 patients. Overall 81% of salvaged cases were successful, resulting in a mean 0.6 cm (95% CI 0.20 to 1.1) reduction in total corporeal length. Delayed reimplantation resulted in a mean 3.7 cm (95% CI 2.9–4.5) total corporeal length loss. In patients who underwent delayed reimplantation the total corporeal length reduction was directly proportionate to the initial penis size of the patient. No statistically significant impact on penile length was attributable to patient age, diabetes, bacterial species or time to reimplantation.

Conclusions: When possible, salvage surgery should be offered to patients with an infected penile implant. Our data confirmed that successful salvage surgery preserves penile length. When a device is explanted and replaced at a later date, patients can expect to lose 15% to 30% of penile length irrespective of age, diabetes, type of infecting organism and time to reimplantation.

Key Words: penile prosthesis, penile implantation, salvage therapy, infection, organ size

Abbreviation and Acronym

TCL = total corporeal length

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DEVICE infection remains the most catastrophic complication of penile implant surgery. Despite several technical and device related modifications that have dramatically reduced the overall incidence[1–3] infections often develop within the first 6 months following surgery[2–4] and they are almost always treated with removal of the entire prosthesis.[5] Unfortunately

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the ensuing corporeal fibrosis creates technical challenges for future surgery and causes irreversible penile shortening, which may adversely impact future device efficacy and patient satisfaction.[5–8]

Salvage procedures have demonstrated an 80% to 93% success rate in select patients with an acutely infected penile implant.[9–11] The procedure requires the removal of all components of an infected device, followed by irrigation of the peri-implantation spaces with various antiseptic solutions designed to eradicate bacteria and disrupt any associated biofilm that may be present. A new implant is placed at the same time, which ideally would maintain penile length.

Despite its promise to our knowledge there have been no randomized trials for comparison and little objective data substantiating the long-term benefits of salvage surgery, particularly for preserving penile length. Without these data salvage surgery remains underused with recent data suggesting that the overwhelming majority of infected implants are removed rather than salvaged.[12]

The primary objective of this observational study was to directly compare the alterations in penile length following salvage of an infected implant with those that develop when the device is removed and reimplanted at a later date. Additional information that we believed to be important for counseling patients with an infected implant included whether time to delayed reimplantation contributes to additional loss of penile length and whether other factors such as patient age, diabetes or the organism implicated in the infection impact the degree of fibrosis and subsequent penile length. To accomplish this we evaluated consecutive patients who presented to our center with an infected penile implant that was immediately salvaged or removed and reimplanted at a later date.

MATERIALS AND METHODS

The study cohort of patients was derived from a comprehensive prospective database of consecutive patients who underwent penile implant surgery performed by 1 surgeon (BRK) between February 2000 and May 2017. Presenting signs and symptoms of implant infection generally exist along a spectrum of severity. Pump fixation or persistent pain and swelling that extend beyond the usual 6-week recovery period are subtle signs that an implant may be infected. At the other end of the spectrum are patients who present with cellulitis, local tissue destruction or fulminant sepsis. Except for patients who present with cellulitis, gross purulence in the corporeal bodies, signs of a systemic inflammatory response, loss of urethral integrity or evidence of penile ischemia, all those who presented to our center with clinical suspicion of an infected implant based on the mentioned criteria were encouraged to undergo salvage surgery.[2–4,6]

For study purposes only patients with an infected implant that was salvaged or who underwent removal with delayed reimplantation were considered for analysis. Descriptive data included patient age, comorbidities and TCL at the time of initial device placement and at salvage or delayed reimplantation. The TCL measurement represents the sum of the size of the cylinder used along with the size of any rear tip extenders that were added.

Additional information abstracted from the database included the organism isolated from the implant space cultures as well as the time in months to delayed reimplantation. In 1 patient who underwent primary implant placement and removal elsewhere the medical records from the other center were obtained and abstracted into the database.

Statistical Methods

Visual and numerical exploratory data analysis methods were used to interrogate data on this cohort of patients. Density describing final length was created with loess smoothing methods. The paired t-test was applied to compare differences in TCL and cylinder size (initial vs final) in men who underwent salvage procedures and those who underwent removal with delayed reimplantation. Unadjusted TCL and cylinder sizes in men who did and did not delay prosthesis replacement were assessed using the Welch 2-sample t-test. The final TCL was predicted using linear models adjusting for initial TCL. Specifically for the primary analysis a linear model predicting final TCL was built using initial TCL, a binary indicator for salvage vs delayed procedures and the interaction between the variables. For men who delayed replacement we used linear models and spline regression techniques to assess the percent of length lost as a function of delay. Further, 3 separate exploratory linear models were built predicting final length as a function of patient age, the presence of gram-positive bacteria and diabetes after adjusting for initial length.

All analyses were done with Base R, version 3.4.1, and the tidyverse 1.1.1 and ggthemes 3.4.0 packages (https://cran.r-project.org/) with $p < 0.05$ considered statistically significant.

RESULTS

The study group consisted of 21 men undergoing immediate salvage surgery and 19 undergoing removal with delayed reimplantation for acutely infected penile implants. Patients presented for salvage or explantation a median of 1.47 months (range 0.6 to 121) after the initial implant. Only 2 patients per group presented for surgery beyond 6 months. The table lists summary statistics on the 2 groups of patients. [T1]

In the salvage cohort salvage failed in 4 patients due to persistent infection and they subsequently underwent device explantation. Another 2 other patients in this group underwent repeat salvage surgery, which was ultimately successful. Overall salvage surgery was successful in 17 of 21 patients (81%).

In 3 patients in the delayed reimplantation group infections of the reimplanted device developed. They subsequently underwent a second explantation and