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Multi-Stage Surgical Treatment of Penile Squamous Cell Carcinoma: Primary Tumor and Nodal Management Outcomes in a Retrospective Cohort

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Abstract

Background: Multi-stage surgical management of penile squamous cell carcinoma (PSCC) requires sequential decision-making from primary tumor treatment through extensive lymphadenectomy, the lack of adherence to treatment indications and prognostic stratification remaining clinical challenges. This study assessed outcomes and prognostic determinants in patients undergoing staged surgical treatment.

Methods: This retrospective cohort study analyzed 49 patients with surgically treated PSCC with surgical indication for bilateral inguinal-femoral lymphadenectomy (ILND) following curative-intent primary tumor resection between October 2020 and December 2024 in a tertiary Romanian oncological surgery center. Primary endpoints included overall survival (OS), treatment completion rates and prognostic factor identification through univariate and multivariate Cox regression analysis.

Results: Among 49 patients (median age 64 years), 31 (63.3%) completed second-stage bilateral ILND, while 18 (36.7%) remained non-compliant. Pathological staging revealed pN0-N1 in 36.7%, pN2 in 42.9% and pN3 in 20.4%. Eleven patients (22.4%) underwent third-stage pelvic lymphadenectomy (PLND). Overall mortality reached 55.1% (27/49) with median OS of 20 months. Patients requiring third-stage pelvic dissection demonstrated 90.9% mortality and median OS of only 12 months. Multivariate analysis identified three independent prognostic factors for OS: absence of lymphovascular invasion (LVI) (HR 0.43, 95% CI: 0.19-0.99, p = 0.048), absence of urethral invasion (HR 0.36, 95% CI: 0.12-1.03, p = 0.056) and pathological N stage. Each additional positive lymph node increased mortality hazard by 4% (HR 1.04, 95% CI: 1.01-1.06, p = 0.002).

Conclusions: Multi-stage surgical management of PSCC faces a low level of patient compliance (63.3%) and identifies high-risk populations through staged progression. While LVI, urethral invasion and nodal stage provide independent prognostic stratification, patients meeting third-stage pelvic dissection criteria exhibit poor outcomes despite complete surgical staging, suggesting these patients may benefit more from integrated systemic therapy approaches than from extended surgery alone.

Keywords: lymphadenectomy, lymphovascular invasion, multi-stage surgery, penile cancer, prognostic factors, squamous cell carcinoma, survival, urethral invasion