

APPENDIX S2 VAGINAL CANCER

- 1.1 Standardized ultrasound report for vaginal cancer assessment
- 1.2 FIGO / TNM staging
- 1.3 Methodology

1.1. Standardized ultrasound report for vaginal cancer assessment

Ultrasound parameter	Description of vaginal cancer
Tumor identification	Yes/No. If yes, assess tumor echogenicity and perfusion using Colour Score. [§]
Tumor location	Lower third/ upper two thirds Anterior/lateral right/lateral left/posterior
Tumor size (millimeters)	Greatest dimension
Local extent	Involvement of the following structures: <ul style="list-style-type: none"> ▪ Paravaginal tissues (urethra-/vesicovaginal/rectovaginal septa, paracolpium right/left) ▪ Urethra ▪ Rectum ▪ Pelvic floor muscles (e.g., middle level – deep urogenital muscles, upper level- diaphragma pelvis) ▪ Pelvic side wall* ▪ Others
Bladder and rectal invasion	Sliding sign ⁽¹⁾ : <ul style="list-style-type: none"> • positive sliding sign (the tumor slides over the bladder and/or rectum) • negative sliding sign (tumor is fixed against bladder and/or rectum) Bladder and/or rectal involvement grading ⁽²⁾ : <ul style="list-style-type: none"> ▪ Grade 0: Intact echogenic layer of fibrous and fat tissue between the bladder and/or the rectum and vagina and/or the cervix. ▪ Grade 1: Disruption of the echogenic outer layer of the bladder and/or rectum but no other signs of invasion ▪ Grade 2: Disruption of the hyperechogenic muscle layer but no abnormalities of the inner wall architecture. ▪ Grade 3: Disruption of all layers with intraluminal tumor spread. In case of bladder trigone involvement ureteric infiltration right/left (yes/no)
Regional (inguinofemoral) and pelvic) lymph nodes	Description of site, number, laterality Assessment of lymph node status using the classification LN1 – LN5 ⁽³⁾ : <ul style="list-style-type: none"> ▪ LN1: Normal finding ▪ LN2: Benign finding ▪ LN3: Indeterminate, probably benign finding ▪ LN4: Probably malignant finding ▪ LN5: Malignant finding
Distant spread	Distant lymph nodes (site, number, lymph node status LN1-LN5, see above) Other distant spread
Other findings	Related /unrelated gynecologic/non-gynecologic pathologies (vagina, cervix, uterus, ovaries and others)
Staging system	TNM and FIGO staging system (Table S2) ⁽⁴⁻⁶⁾ Comments and recommendations to additional diagnostic tests to the referring specialist and to multidisciplinary team meeting
<p>[§]Colour score following IOTA (International Ovarian Tumor Analysis) terms and definitions (Color Score 1, no perfusion; Color Score 2, minimal perfusion; Color Score 3, moderate flow; Color Score 4, highly vascularized.⁽⁷⁾</p> <p>*Pelvic side wall is defined as the parietal muscles of the lesser pelvis (obturatorius internus, coccygeus, and piriformis muscle), fascia, neurovascular structures, or skeletal portions of the bony pelvis.</p>	

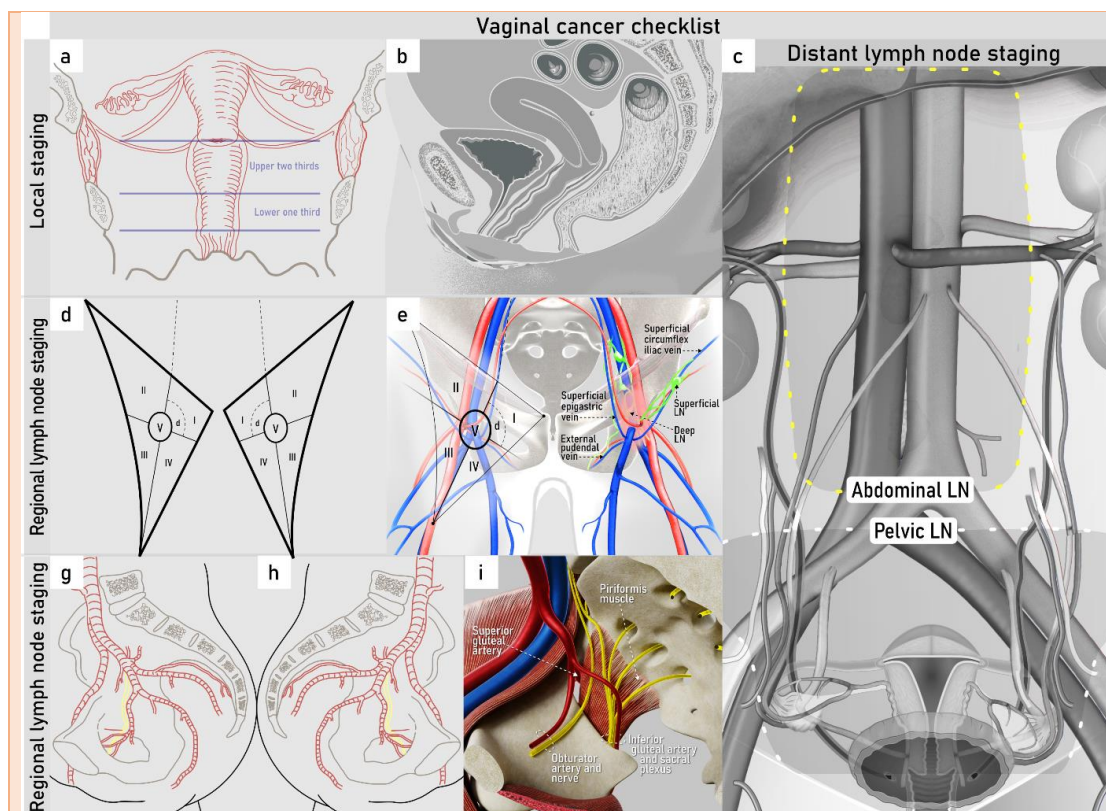


Figure S1 Schematic documentation of vaginal cancer staging by ultrasound

Ultrasound documents the location and extension of primary tumor (local staging, a, b), and any suspicious lymph nodes (size of lymph node and intranodal metastasis, the number of lymph nodes involved, the presence or absence of extracapsular spread and others)(c-i). For local staging, schematics showing the coronal view of the pelvic anatomy (a) and the sagittal view of pelvic anatomy (b). The upper two thirds of the vagina is drained by lymphatics to the pelvic nodes (c), while the lower third of the vagina also drains to the groin nodes (d-e). The regional lymph nodal status in the groins is documented by ultrasound according to a standardized report published in 2021 by the Vulvar International Tumor Analysis (VITA) collaborative group (d, e).⁽³⁾ For describing the location of superficial lymph nodes in the groins using Daseler regions (I-V), the femoral triangle is divided into 4 quadrants by the femoral vein and a virtual line drawn perpendicular to it passing through the saphenofemoral junction: superomedial region (I); superolateral region (II); inferolateral region (III); and inferomedial region (IV). The central zone (V) is circled. Deep lymph nodes in the groins are located medially to the femoral vein and cranially to the lower margin of oval fossa (d, e). In the scheme (d), the location of deep lymph nodes is marked as 'd'. The regional pelvic lymph nodes can be plotted on a diagram of the right (g) and left (h) iliac vessels with the corresponding anatomical diagram (i). Distant (abdominal) lymph nodes are delineated by the yellow dashed line (c).

Table S1 Ultrasound checklist on vaginal cancer based the consensus of the authors

2021 FIGO staging system / 2016 TNM (8th edition)

FIGO	AJCC	T	N	M	DEFINITION
I	IA	T1a	N0	M0	The cancer is only in the vagina and is no larger than 2 cm (T1a). It has not spread to nearby lymph nodes (N0) or to distant sites
I	IB	T1b	N0	M0	The cancer is only in the vagina and is larger than 2 cm (T1b). It has not spread to nearby lymph nodes (N0) or to distant sites
II	IIA	T2a	N0	M0	The cancer has grown through the vaginal wall, but not as far as the pelvic wall and is no larger than 2 cm (T2a). It has not spread to nearby lymph nodes (N0) or to distant sites (M0).
II	IIB	T2b	N0	M0	The cancer has grown through the vaginal wall, but not as far as the pelvic wall and is larger than 2 cm (T2b). It has not spread to nearby lymph nodes (N0) or to distant sites (M0).
III	III	T1 to T3 OR T3	N1 N0	M0 M0	The cancer can be any size and might be growing into the pelvic wall and/or has blocked the flow of urine (hydronephrosis) which is causing the kidneys to not work. (T1 to T3). It has also spread to nearby lymph nodes in the pelvis or groin (inguinal) area (N1) but not distant sites (M0). The cancer is growing into the pelvic wall and/or has blocked the flow of urine (hydronephrosis) which is causing the kidneys to not work. (T3). It has not spread to nearby lymph nodes (N0) or to distant sites (M0).
IVA	IVA	T4	Any N	M0	The cancer is growing into the bladder or rectum or is growing out of the pelvis (T4). It might or might not have spread to lymph nodes in the pelvis or groin (inguinal area) (Any N). It has not spread to distant sites (M0).
IVB	IVB	Any T	Any N	M1	The cancer has spread to distant organs such as the lungs, liver, or bones. (M1). It can be any size and might or might not have grown into nearby structures or organs (Any T). It might or might not have spread to nearby lymph nodes (Any N).

Table S2 FIGO, AJCC and TNM staging for vaginal cancer ^(4, 5)

1.2. Methodology of loco-regional ultrasound staging in vaginal cancer

The sonographer uses three main probes to assess the pelvis, abdomen, and groins for vaginal cancer staging (Figure S2). **The transvaginal/transrectal approach** using endoluminal high-resolution probe assesses accurately the morphology, location, and topography of the vaginal tumor. For the correct assessment of local tumor staging, knowledge of vaginal anatomy on the ultrasound is essential. The vaginal mucosa appears as a hyperechoic thin layer and the muscular layer of the vaginal wall is iso-/hypoechoic.⁽⁸⁾ A study by Pozzati et al described the ultrasound features of vaginal lesions suggesting that benign lesions typically appear as unilocular cyst or hypoechoic solid tumour with no or minimal vascularization on colour Doppler examination.⁽⁹⁾ In contrast, malignant vaginal lesions appear mostly as hypoechoic solid tumors, often with irregular margins and moderate to rich vascularization. Transvaginal/transrectal sonography is also useful evaluating the spread into the paravaginal tissues (septa, paracolpium, pelvic floor muscles) and invasion of the urethra/bladder/rectum/anal canal and pelvic lymph nodes.⁽²⁾ Concomitant occult pathologies in the pelvis may be occasionally found at the same time. The transrectal approach may be preferable as it allows to overcome the mechanical obstruction caused by the tumor and provides a better visualization of the tumor extent in the vagina while minimising the risk of bleeding. **The transabdominal approach** using a convex probe is used to evaluate abdominal spread and pelvic lymph nodes which are out of scope of transvaginal/transrectal sonography (such as external iliac lymph nodes ventrally located close to the lacuna vasorum or common iliac lymph nodes). **Transcutaneous approach** using a linear array probe is the imaging modality of choice for visualization of the inguinofemoral lymph nodes, which collect lymphatic drainage from the tumors in the middle and lower thirds of the vagina.^(10, 11)

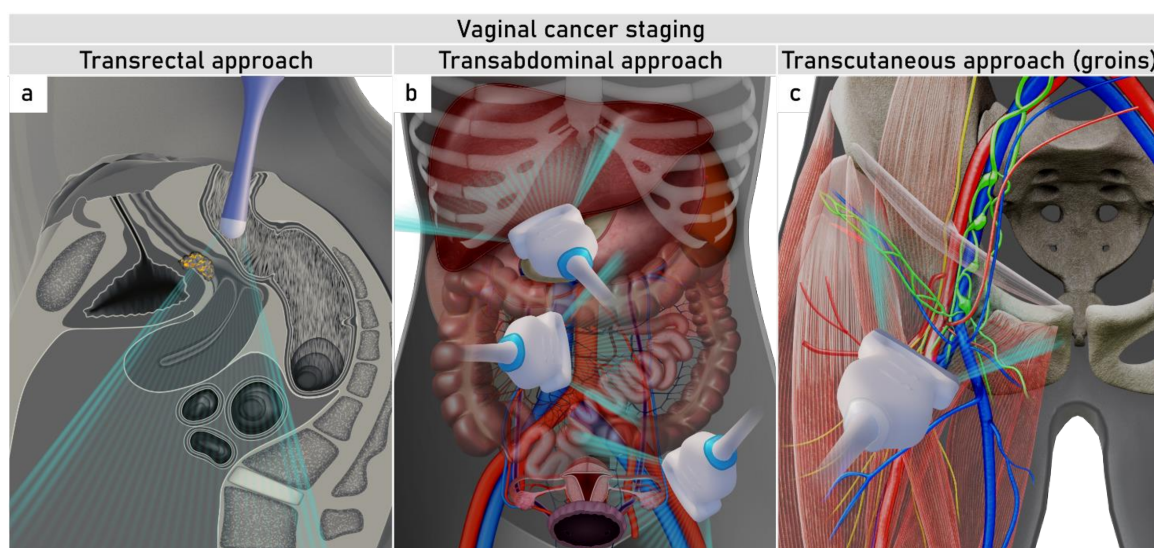


Figure S2 Ultrasound approaches for vaginal cancer staging

Transrectally inserted endoluminal probe (a). Transabdominal approach with convex array probe (b). Transcutaneous approach with linear array probe for inguinofemoral lymph nodes evaluation by (c).

Localization of tumor and infiltrated regional and distant lymph nodes should be documented in a schematic drawing (Figure S1) within a standardized systematic checklist (Table S1).

References

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