

# Diagnostic Imaging Pathways - Cervical Cancer (Staging)

## Population Covered By The Guidance

This pathway provides guidance on the staging of cervical cancer.

**Date reviewed: April 2019**

**Date of next review: April 2022**

**Published: July 2019**

## Quick User Guide

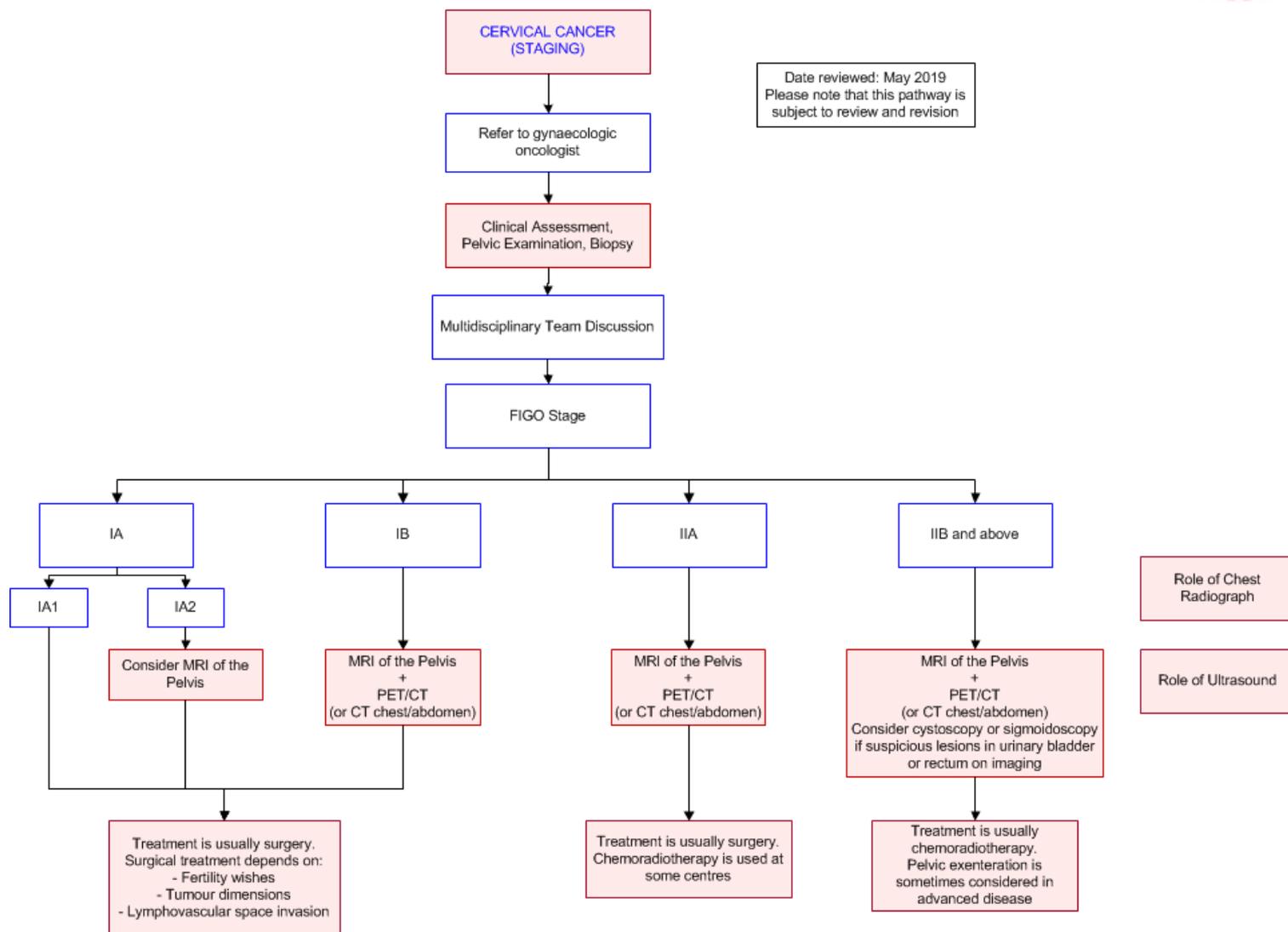
Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

## Pathway Diagram



## Image Gallery

*Note: Images coming soon*

## Teaching Points

- Staging of cervical cancer has traditionally been performed with clinical assessment and biopsy
- Imaging has been found to better evaluate the extent of disease and often changes management. Imaging investigations are recommended when they are available
- MRI is the best imaging modality to assess the primary tumour size, location, and invasion into the parametrium, pelvic sidewall and adjacent organs
- PET/CT is the best modality to assess nodal and extrapelvic metastatic disease, and is recommended in patients at high risk of lymphatic involvement
- Treatment for early stages of cervical cancer is generally surgical whereas chemoradiotherapy is usually indicated in advanced disease



## Cervical Cancer

- Globally, cervical cancer remains the fourth most common cancer in women
- It is now recognised that cervical cancer is a rare long-term outcome of persistent infection of the lower genital tract by one of the high-risk Human Papilloma Virus (HPV) types [1](#)
- Since the introduction of formal screening programs (Pap smear and now liquid-based cytology and HPV testing) and more recently prevention programs with HPV vaccination, cervical cancer incidence and mortality have halved in high-income countries [2](#)
- The majority of cases now occur in low-income and middle-income countries [1,2](#)
- Cervical cancer spreads by direct extension into the parametrium, vagina, uterus and adjacent organs. It also spreads via lymphatics to regional lymph nodes. Distant metastasis to the lungs, liver and bones is a late phenomenon [1](#)
- Accurate staging is crucial to determine the most appropriate treatment
- The International Federation of Gynaecology and Obstetrics (FIGO) system is the most widely used in cervical cancer staging
- FIGO staging is mainly based on clinical examination, in part because it is accessible in low and middle-income countries. However, evidence suggests that parametrial, pelvic sidewall, bladder and rectal invasion, and metastatic disease are often poorly evaluated on clinical assessment alone [1,3-5](#)
- When available, imaging investigations (ultrasound, CT, MRI and PET/CT) can provide further details about tumour size, nodal status and systemic spread, and can improve staging accuracy, help plan treatment (e.g. radiation therapy fields) and estimate prognosis. Chest radiographs are also helpful in some cases [1-4,6](#)
- The 2018 revision of the FIGO staging system now allows imaging and pathological findings, when accessible, to help assign the stage [1](#)
- Treatment for early disease where the cancer is confined to the cervix/upper vagina is usually with surgery (up to stage IIA) whereas advanced disease where the cancer extends beyond the cervix/upper vagina to involve the parametrium or lower vagina is generally treated with radiation therapy (stage IIB and above). Chemotherapy is a valuable adjunct treatment. Stage IB2 and IIA are also treated with chemoradiation at some centres [7-9](#)

### Staging of cervical cancer based on the International Federation of Gynaecology and Obstetrics (FIGO) and the American Joint Committee on Cancer TNM staging systems [1,2,10,11](#)

FIGO Stage		TNM
I	<b>Cervical carcinoma confined to the cervix</b>	T1
IA	Invasive carcinoma diagnosed only by microscopy with a maximum depth of invasion < 5mm	T1a
IA1	Measured stromal invasion < 3mm	T1a1
IA2	Measured stromal invasion ? 3mm but < 5mm in depth	T1a2
IB	Invasive carcinoma with measured deepest invasion ? 5mm, lesion limited to cervix	T1b



	uteri	
IB1	Invasive carcinoma ? 5mm depth of stromal invasion, and < 2cm in greatest dimension	T1b1
IB2	Invasive carcinoma ? 2cm and < 4cm in greatest dimension	T1b2
IB3	Invasive carcinoma ? 4cm in greatest dimension	
II	<b>Cervical carcinoma invades beyond the uterus but not the pelvic wall or lower third of vagina</b>	T2
IIA	Tumour without parametrial invasion	T2a
IIA1	Invasive carcinoma < 4cm in greatest dimension	T2a1
IIA2	Invasive carcinoma ? 4cm in greatest dimension	T2a2
IIB	With parametrial invasion but not up to the pelvic wall	T2b
III	<b>Carcinoma involves the lower third of the vagina and/or extends to the pelvic wall and/or causes hydronephrosis or non-functioning kidney and/or involves pelvic and/or para-aortic lymph nodes</b>	T3
IIIA	Tumour involves lower third of vagina without extending to the pelvic wall	T3a
IIIB	Tumour extends to pelvic wall, causes hydronephrosis or non-functioning kidney, or both	T3b
IIIC	Involvement of pelvic and/or para-aortic lymph nodes, irrespective of tumour size and extent	
IIIC1	Pelvic lymph node metastasis only	
IIIC2	Para-aortic lymph node metastasis	
IV	<b>Tumour invades mucosa of bladder or rectum, extends beyond the true pelvis, or both</b>	T4
IVA	Spread to adjacent pelvic organs	T4a
IVB	Spread to distant organs	T4b

## Clinical presentation, examination and biopsy

- In its early stages cervical cancer is usually asymptomatic and may be diagnosed on screening or pelvic examination [2](#)
- Symptoms can include post-coital bleeding, abnormal vaginal bleeding, pelvic pain, and profuse malodorous vaginal discharge. Lower limb oedema, flank pain and sciatica in advanced disease suggest pelvic sidewall invasion. Invasive disease can result in passage of urine or faeces through the vagina from vesicovaginal or rectovaginal fistulae respectively [2](#)
- Clinical assessment is the first step in allocation of stage and should include pelvic examination, visualisation of the cervix and vaginal mucosa and cervical cytology [1,2](#)
- Biopsy should be performed when there is obvious macroscopic disease
- In women with positive cytology without visible lesions, a colposcopy and loop electrosurgical excision procedure or cone biopsy is necessary [1](#)
- For microscopic lesions, stage is assigned following conisation when tumour dimensions can be determined histologically. For larger lesions, stage can be determined clinically based on tumour size and the degree of pelvic extension [2](#)

## Magnetic Resonance Imaging (MRI)

- A number of international guidelines (e.g. the European Society for Gynaecological Oncology/European Society for Radiotherapy and Oncology/European Society of Pathology, the European Society for Urogenital Radiology, and the American College of Radiology) recommend pelvic MRI for assessment of pelvic tumour extent. It is recommended for staging of all tumours IB and above, or smaller if fertility sparing surgery is being considered [4,12,13](#)
- MRI is the best imaging modality to assess the primary tumour and is accurate in determining tumour size, location, depth of stromal invasion, parametrial and local extension. This can have significant implications in deciding between surgery or primary chemoradiotherapy and, when surgery is indicated, whether fertility-sparing surgery can be considered [1,4-6,14-17](#)
- For women with advanced disease, MRI provides clear visualisation of the cervical tumour in multiple planes allowing for a reliable volumetric definition of the target tissue for external beam radiation and brachytherapy treatment planning [8](#)
- Overall staging accuracy ranges from 75-96% and tumour measurements are within 5mm of surgical size in 70-94% of cases [4](#)
- Sensitivity for evaluating parametrial invasion ranges from 40-84% and specificity 77-91%. Accuracy is reported to lie between 74-96%. [4,8,18](#)
- A systematic review by Thomeer et al. comparing clinical examination with MRI found a pooled sensitivity of 40% for the evaluation of parametrial invasion with clinical examination compared with 84% with MRI. For the evaluation of advanced disease, sensitivity of clinical examination was 53% compared with 79% for MRI [19](#)
- When evaluating lymph node involvement with MRI, a wide range of sensitivities and specificities have been reported between different studies. [4,20](#) A systematic review of 15 studies involving 1021 patients found a pooled sensitivity and specificity for diffusion weighted imaging (DWI)-MRI in detecting pelvic lymph node metastases of 86% and 84% respectively. [21](#) MRI performs less well in detecting small-volume metastatic involvement of normal sized lymph nodes [22](#)
- Hricak et al. found a similar sensitivity and specificity between MRI and CT for detecting lymph node involvement. [23](#) A meta-analysis by Scheidler et al. also found CT and MRI to perform similarly in detecting lymph node metastasis [24](#)
- Reported sensitivity of MRI in the evaluation of bladder and rectal invasion is 71-100% with a specificity of 88-91%. This has resulted in the reduced use of cystoscopic and endoscopic staging

## Positron Emission Tomography/Computed Tomography (PET/CT)

- Whole body PET/CT is recommended in the pre-treatment evaluation of cervical cancer patients with high risk of lymphatic involvement [22,25,26](#)
- Lymph node metastases are associated with a poor prognosis and undetected lymph node involvement can lead to under-treatment [17,27](#)
  - 5-year survival of early stage cervical cancer is 90% if no lymph-node metastases are present compared to 65% when lymph-node metastases are present
- Most primary cervical cancers show intense FDG uptake, and although PET/CT is of limited value in evaluation of local disease (e.g. does not provide accurate information on parametrial invasion), it is superior to MRI and CT for detecting lymph node involvement, extra-pelvic disease, and tumour recurrence [17,28-36](#)
- Fleming et al. found that a staging PET/CT changed the management of approximately one-third of patients with locally advanced cervical cancer by altering treatment intent and/or radiotherapy planning. [25](#) A study by Morkel et al. who investigated the role of PET/CT in patients with stage IIIB cancers also found that PET/CT affected the management in 40% of patients. 19% required a change in the radiation field due to identification of involved para-aortic lymph nodes and 21% were upstaged to stage IVB [37](#)
- The role of preoperative PET/CT in patients with early cervical cancer (IA), however, is less clear and is thought to not change management in most patients [38,39](#)
- Sensitivity and specificity for detecting metastatic lymph nodes by PET alone are reported to be 75-91% and 94-100% respectively. [4](#) A meta-analysis of 72 studies that included 5042 patients found the pooled sensitivity and specificity of PET for detecting positive lymph nodes was 75% and 98% respectively, higher than MRI (sensitivity 56%, specificity 93%) and CT (sensitivity 58%, specificity 92%) [40](#)
- Sensitivity and specificity for detecting metastatic lymph nodes by combined PET/CT are reported to be 58-82% and 93-99% respectively [4,41](#)
  - False-negative results are seen in 4-15% of cases and false positives can occur due to infection or inflammation
- A number of studies have also found a correlation between PET/CT parameters (such as SUVmax), prognosis and recurrence after treatment. PET/CT is also helpful in follow up [34,42-46](#)
- Combined PET/MRI is gaining popularity in view of its excellent soft-tissue contrast and lack of ionizing radiation exposure. There is promising evidence that PET/MRI may have better diagnostic accuracy than PET/CT in detecting lymph node metastasis and may be superior to MRI alone for treatment planning [33,47-50](#)

## Ultrasound (US)

- Although early studies reported a limited role for US in cervical cancer staging, more recent studies investigating the utility of transvaginal and transrectal US have found similar local staging accuracy to MRI when performed by experienced operators [1,17,51](#)
- Transvaginal and transrectal US have a high sensitivity and specificity for the assessment of tumour size and depth of stromal invasion. They have high specificity and moderate sensitivity in evaluating parametrial involvement. There is currently insufficient data evaluating the ability of ultrasound to detect tumour growth into the vagina, infiltration of the vesico-vaginal septum, infiltration into the recto-vaginal septum, and lymph-node metastases [17,52](#)

- A study by Han et al. of 80 women who underwent surgical treatment found that transvaginal US had a pre-operative staging accuracy of 92.5% when compared to histology findings. They also found that US was effective in estimating depth of invasion [53](#)
- Transabdominal US is a sensitive, non-invasive means of detecting hydronephrosis but otherwise has a limited role in assessing the local extent of cervical cancer. In cases of grossly invasive disease which has not been imaged with cross-sectional modalities, an ultrasound of the renal tract can be helpful to identify this [4,54](#)
- Advantages of US include: [17,51](#)
  - Relatively inexpensive
  - Widely available
  - Relatively quick to perform
  - No ionising radiation

## Chest radiograph

- In patients with frank invasive carcinoma a chest radiograph is recommended [1,54](#)
- Chest radiographs can identify a pleural effusion or pulmonary metastases which can occur in the late stages of cervical cancer. However, chest CT is superior to chest radiographs in both of these circumstances [4](#)
- A number of guidelines include routine chest radiography as the primary diagnostic instrument for detection of thoracic metastatic disease, however, there is limited original research to support this [55](#)
- A study by Hoogendam et al., aimed to assess the utility of routine chest radiographs in cervical cancer patients. They found that chest radiography did not identify pulmonary or skeletal metastases (or incidental pathology requiring treatment) in any of the 244 patients with stage I/II disease. There was no change to the management of these patients. Chest radiographs did lead to upstaging two patients with stage IIIB and IVA cancer. They concluded that there is no value in performing routine chest radiography in the workup of early stage (stage I/II) disease, and it is only in advanced disease (stage III/IV) that continued use of routine chest radiography can be considered if cross-sectional imaging is not routinely employed or available [56](#)

## Computed Tomography (CT) of the Chest/Abdomen

- There is consensus in the literature that CT is valuable in patients with advanced disease, but is of limited value in patients with early disease [4](#)
- CT is an accurate tool for recognising distant metastases to the liver and to the lungs, and is also useful to detect urinary obstruction [17,57](#)
- For patients with high risk of metastatic disease, contrast CT of the chest, abdomen and pelvis may be useful. It may also be helpful when MRI is contraindicated
- Owing to its relatively poor soft-tissue contrast resolution, CT usually does not accurately differentiate between tumour and normal cervical stroma or parametrial structures (cervical cancer appears isodense compared with adjacent normal structures). CT is therefore of limited utility in local staging [17,57](#)
- Sensitivity for parametrial invasion ranges from 17-100%, with an average of 64% [4](#)
- Overall staging accuracy ranges from 32-80% [4](#)
- Pooled sensitivity and specificity for detection of lymph node metastases are 50% and 92% respectively. The low sensitivity is thought to be because the reliance on size criteria alone (> 1cm) to diagnose malignant lymphadenopathy misses micrometastases

- CT can also assist with radiation therapy planning and guide interventional procedures [4](#)

## Cystoscopy and Sigmoidoscopy

- Cystoscopy or sigmoidoscopy may be considered to provide a biopsy if there are suspicious lesions in the urinary bladder or rectum on imaging [12,54](#)

## Treatment

- Treatment for early disease (up to stage IIA) where the cancer is confined to the cervix/upper vagina is usually surgery [7-9](#)
- Advanced disease (stage IIB and above) where the cancer extends beyond the cervix/upper vagina to involve the parametrium or lower vagina is generally treated with radiation therapy. [7-10](#) Surgery is unlikely to be curative in these patients and is associated with a high risk of adverse events and morbidity. [2](#) Stage IB and IIA tumours are also treated with chemoradiation at some centres
- Chemotherapy is a valuable adjunct treatment in some circumstances [7-9](#)
- Definitive chemoradiotherapy and brachytherapy are recommended in patients with unequivocally involved pelvic lymph nodes on imaging. Debulking of suspicious pelvic lymph nodes may be considered [12](#)
- Surgical treatments can include: [1,2](#)
  - Cervical conisation
  - Trachelectomy
  - Hysterectomy – simple extrafascial or radical depending on the stage of disease
  - Pelvic and para-aortic lymphadenectomy
  - Pelvic exenteration
- Stage of disease, lymphovascular invasion on histology, and fertility wishes of the patient are important factors to consider when deciding on the most appropriate surgical treatment
- A tumour of ? 2cm is often used as a cut-off when considering fertility-sparing trachelectomy in women with stage IB1 tumours [2,10](#)

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