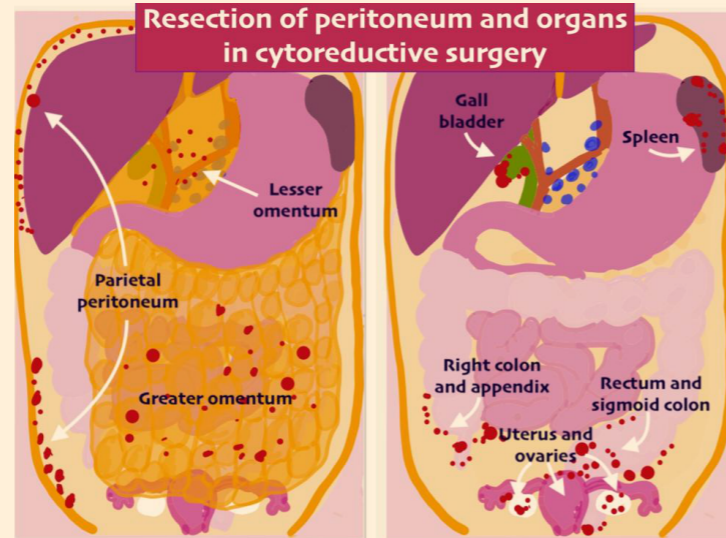


Similarly, the peritoneum in the other regions of the peritoneal cavity was removed during a surgery that lasted 8 hours and she was declared 'Cancer Free'. She had to stay in the hospital for 12 days after the surgery and complete recovery took 6 weeks. After that, she was able to complete her chemotherapy. Soon after completion of chemotherapy, she got back to work and has been living a normal healthy life for more than two years (34 months).

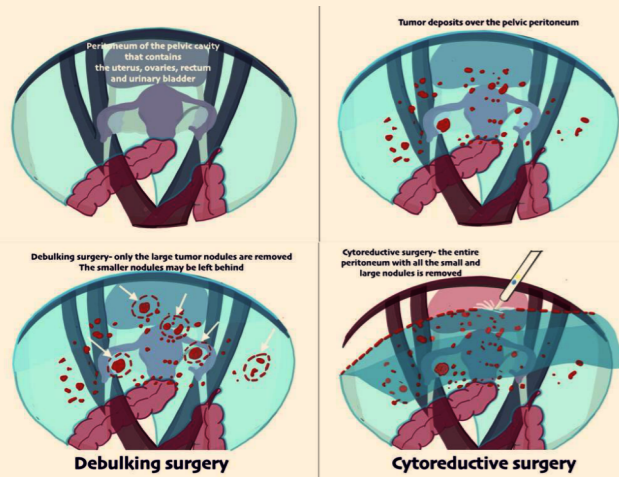
Surgery is very important for the treatment of ovarian cancer. Without surgery, neither cure nor long-term survival is possible. Many times such extensive tumours are declared inoperable by surgeons, not well-versed/ familiar and/or experienced with 'cytoreductive surgery' or peritonectomy procedures. When treated with chemotherapy alone, the life span is significantly shortened and patients have many physical problems like difficulty in passing urine and stool, abdominal pain and swelling and gradual loss of appetite that greatly bring down the quality of life. At our centre, we have an ongoing clinical study in which the entire parietal peritoneum is removed in patients who have received chemotherapy first. With this approach, less than 10% of the patients develop recurrence within the first 6 months of surgery (or platinum resistance recurrence) compared to 35-40% in published scientific literature. Even when the disease recurs, few of the patients have symptoms and it is easily treated with oral or IV chemotherapy. Cytoreductive surgery can change the life of



the patient and enable them to live a much longer, disease-free life with no physical ailments/problems.

What is the Benefit of HIPEC?

HIPEC involves the circulation of a heated chemotherapy solution in the peritoneal cavity for 60-90 minutes. HIPEC adds to the benefit of radical surgeries. It helps in treating the microscopic disease more effectively leading to reduced risk of recurrence and delays the recurrence as well. Some studies have also shown that the incidence of peritoneal recurrence is reduced with HIPEC. The most common chemotherapy drug used for HIPEC is Cisplatin. In ovarian cancer, cisplatin resistance is a major problem leading to early recurrence and shorter survival. The heat used in HIPEC can be useful in overcoming Cisplatin resistance. Very old and frail patients may not be able to tolerate HIPEC. Similarly, those who have kidney dysfunction, uncontrolled diabetes or other major health issues are not subjected to HIPEC to avoid severe complications. Currently, HIPEC is recommended to only select a group of patients with ovarian cancer undergoing surgery after a few cycles of chemotherapy. In this scenario, performing HIPEC in addition to cytoreductive surgery increases the lifespan by one year or more over what is achieved with surgery and chemotherapy.



GIVING THE NATION
THE **CANCER CARE**
IT **DESERVES**

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Bladder Preservation in Bladder Cancer: How Technology Makes a Difference



Dr. Raj Patel
Uro Oncologist & Robotic Surgeon

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PSMA PET and MR Fusion: ONE-STOP Investigation for Staging of Prostatic Malignancy



DR. Shweta Thakkar
Radiologist

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Compartmental Resection - A Technique to Treat Advanced (T4b) Oral Cancers



Dr. Supreet Bhatt
Head & Neck Onco

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How Treating Advanced Ovarian Cancer with Cytoreductive Surgery and HIPEC Delays Recurrence and Prolongs Overall Survival



Dr. Aditi Bhatt
GI, Gynecological and Peritoneal Surface Oncologist



Bladder Preservation in Bladder Cancer: How Technology Makes a Difference



Dr. Raj Patel
MS, DNB
Urologist & Robotic Surgeon

Though radical surgery for cancers removes cancer at its best, it leaves patients with permanent disability due to loss of function from organ removal. Invasive bladder cancer needs radical cystectomy with urinary diversion. Urothelial carcinoma of bladder diverticulum is a unique situation where sometimes the radical approach is overkill & bladder preservation is risky due to high chances of local recurrence. In one such situation, the modern imaging techniques along with minimally invasive robotic surgery helped us to achieve the best oncological outcome without functional loss.

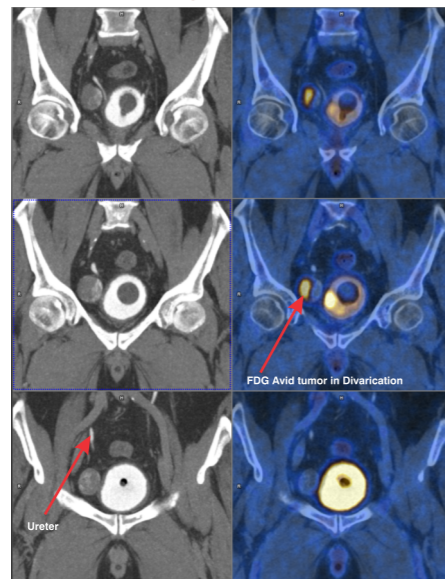
Case Details

A 70-year-old obese (BMI 47 kg/m²), male patient from Ahmedabad was evaluated for hematuria & was diagnosed with Bladder diverticulum with diverticular tumour. His traumatic hospitalization experience during COVID & the unfortunate demise of his life partner held him back from visiting a hospital & taking proper medical advice for the same for 3 months. For gross hematuria & clot

retention, he underwent emergency clot evacuation with a bladder biopsy from diverticular growth, which revealed low-grade urothelial carcinoma. Since the neck of diverticulum was narrow, the complete cystoscopic evaluation of the tumour was not possible. The contrast CT abdomen-pelvis done elsewhere failed to differentiate between the tumour and clots within the diverticulum with a limited assessment of any extra diverticular disease. This inconclusive report for 'T' staging created a clinical dilemma of further treatment. To decide the staging, at Zydus Cancer Centre, we decided to use the best imaging technique to characterize the lesion to decide between organ preservation versus radical surgery. He underwent an FDG-PET-CT scan with MR screening which gave us a fair idea of localized disease (clinically T1, node negative disease, no distant metastasis).

The next major challenge was the surgery itself. Apart from anaesthesia risk, he had high chances of surgical complications. Considering his obesity & recent diagnosis of diabetes mellitus, the open surgery could have resulted in technically challenging surgery, a long recovery period and possible wound-related & other complications. After counselling & a detailed discussion about surgical options, he opted and underwent robotic-assisted bladder diverticulectomy with pelvic lymph node dissection. He further had an excellent recovery. He was fully ambulatory with a solid oral diet on day 2 after surgery and was discharged on the 3rd day post-operative without any peri-operative events. The catheter was removed on the 14th day. The final pathology was organ-confined disease

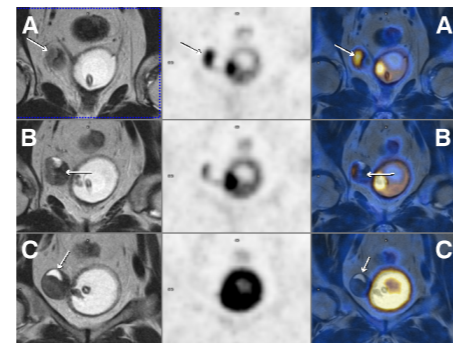
FDG PET CT Images



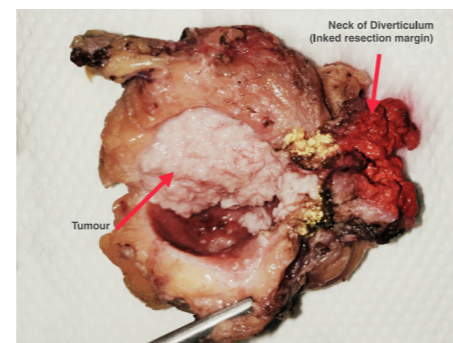
(Low grade, pT1, pNo). The two goals of cancer treatment, the oncological control with functional preservation were very well achieved.

So what helped us in this case? First, the decision to do PET-CT with MR fusion for staging gave us perfect 'T' Staging which was a major deciding factor between radical versus bladder preservation surgery. MRI provided excellent soft-tissue contrast & spatial resolution which helped differentiate between tumour and clot. This was backed with functional imaging of PET-CT. Second, the minimally invasive surgery in the form of Robotic surgery made a huge difference in surgical outcome. Backed by the excellent 3D vision and endo-wrist instruments, the surgery went smoothly without intra-operative events. Additionally, the Robotic System equips a surgeon with 3 working instruments and surgeon controlled 3D vision camera, which is a big help in an obese patient as the surgeon needs minimum help from an assistant. The use of robotic instruments made it possible to prevent any tumour spillage with minimal blood loss.

In the end, advanced imaging techniques and benefits of the Robotic Surgery System made it possible for us to send the patient home without cancer, any functional loss, any complications & with a big happy smile.



FDG PET - MR Fusion Images
A. Tumor • B. Blood Dots • C. Urine



PSMA PET and MR Fusion: ONE-STOP Investigation for Staging of Prostatic Malignancy



Dr. Shweta Thakkar
MD
Radiologist

Prostate cancer is one of the top ten leading cancers in India. It usually affects men in the age group of 65+ years. However, recently there has been an increase in reports of cancer in younger men. Multiparametric MRI (mpMRI) and 68Ga-PSMA PET-CT are two well-established modalities in its investigation.

Multiparametric MRI (mpMRI)

When it comes to evaluation and staging of the disease, multiparametric MRI (mpMRI) has been the imaging modality of choice for the local staging of prostatic cancer and has an incremental value in assessing pelvic nodal disease and bone involvement. Accurate local staging is critical for treatment planning and

prognosis in patients with prostate cancer. The primary aim is to differentiate between organ-confined and locally advanced diseases with the latter carrying a worse clinical prognosis.

MRI has a high specificity for diagnosing Extracapsular Extension (ECE), Seminal Vesicle Invasion (SVI) and Lymph Node (LN) Metastases, however, sensitivity remains limited. Due to its excellent soft-tissue differentiation, MRI remains the gold standard for morphological evaluation and local staging of Prostatic malignancy.



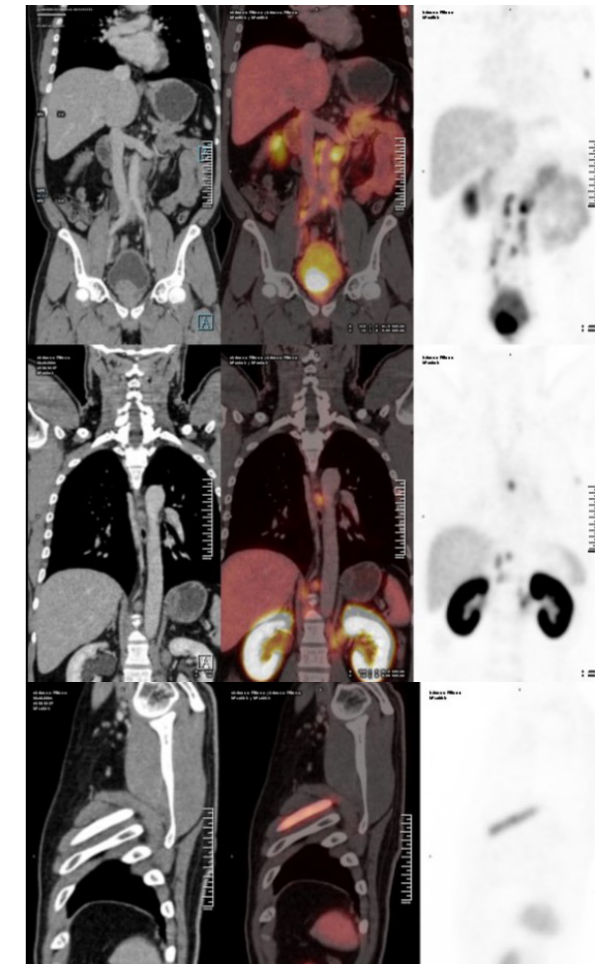
High resolution T2W, DWI and ADC demonstrating a tiny lesion in right peripheral zone (marked with arrows).

Limitation of MRI Alone

Additional investigation is required in metastatic diseases.

68Ga-PSMA PET-CT Scan?

When it comes to the functional imaging aspect, Prostate-specific Membrane Antigen (PSMA) Positron Emission Tomography (PET) has been extensively studied, and the results are robust and promising. The use of PSMA PET imaging is well established for evaluating tumour detection, nodal and metastatic disease evaluation in primary staging, assessment of therapeutic responses and treatment planning. It plays an important role in detecting biochemical recurrence, even at low prostate-specific antigen (PSA) levels.



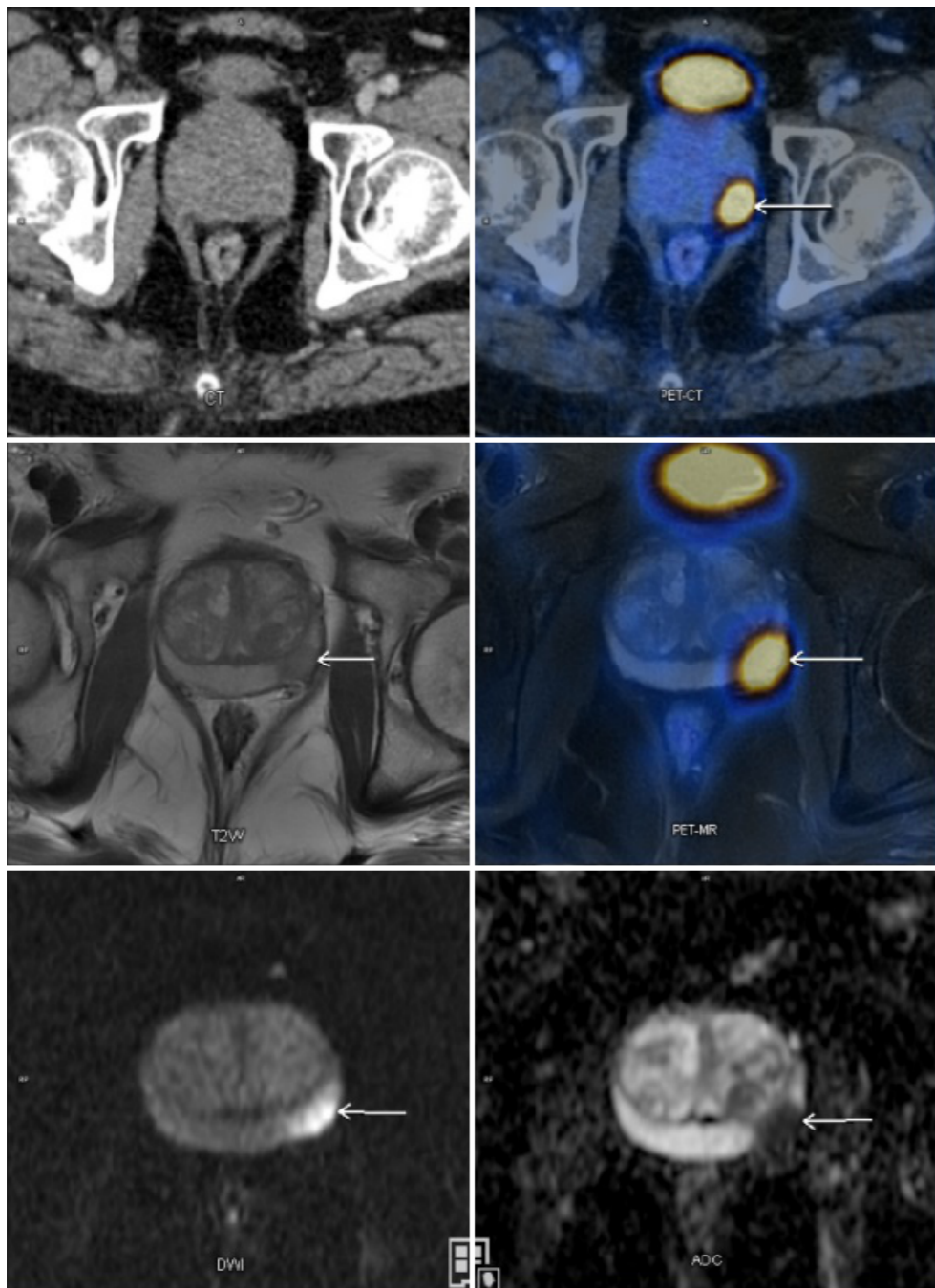
68Ga-PSMA PET-CT scan-demonstrates extensive nodal and bony metastases in a case of Prostatic carcinoma.

Limitation of PSMA PET-CT Alone

Limited information regarding the local extent (T stage) of the disease.

Hybrid Fusion Imaging

With the use of a software-based fusion of PSMA PET and MRI, we can combine the benefits of both the modalities and achieve a powerful morpho-functional tool for the overall staging of prostatic malignancy. Moreover, now with version 2 of Prostate Imaging-Reporting and Data System (PI-RADS) placing more emphasis on T2W and DWI of MRI, it is possible to have an abbreviated MRI protocol and its accurate software-based fusion with PSMA-PET CT images to provide a comprehensive imaging modality.



PSMA PET-CT AND MR FUSION-showing excellent combination of functional and morphological information.

Benefits of Hybrid Imaging over Individual Counterparts

- 1) Provides comprehensive evaluation for local as well as distant disease extent in one go.
- 2) Provides best morphological as well as functional details.
- 3) Increased Diagnostic confidence and localization of prostate limited diseases.
- 4) Also has a significant role in follow-up patients after radical prostatectomy with small suspicious local recurrences.

Compartmental Resection - A Technique to Treat Advanced (T4b) Oral Cancers

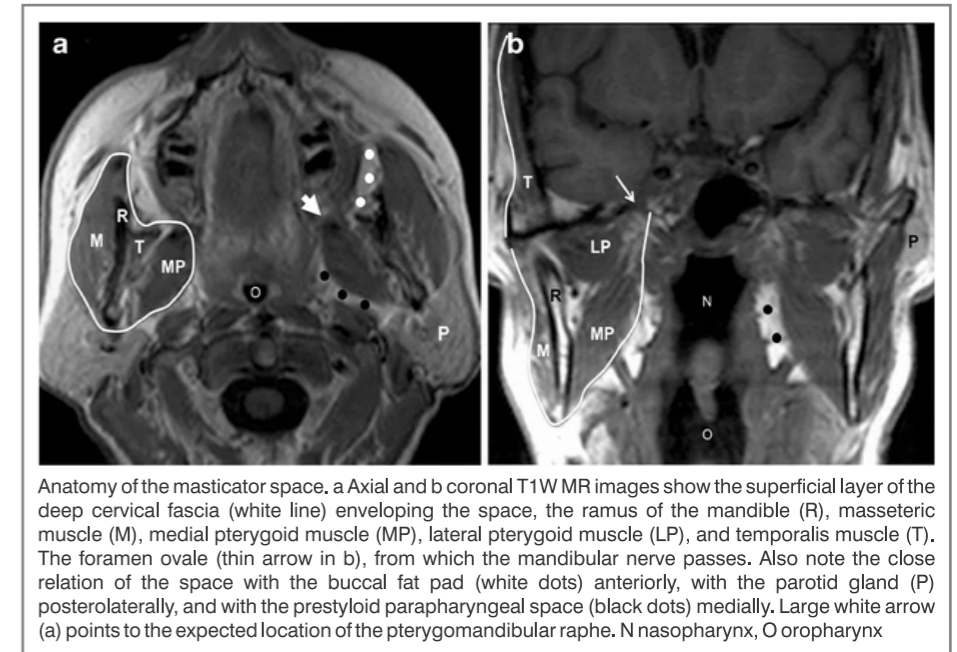


Dr. Supreet Bhatt
Ms. M.ch. (Onco Surgery)
Head & Neck Cancer Surgeon,
Skull- Base Cancer Surgeon

Oral cancer with masticator space involvement is an advanced disease (classified as stage T4b in the AJCC staging system) and one that is difficult to treat. These patients form a significant clinical burden in this part of the world.

Oral cancers presented at T4b stages are traditionally considered unresectable and are most commonly managed with palliative intent treatment (Chemotherapy and/or Radiotherapy). Non-surgical approaches give extremely poor survival results ranging from 2-12 months.

Surgery remains the cornerstone of Treatment for Advanced stage oral cancer if operated with adequate oncological margins and with acceptable safety, the surgery is the best available modality to treat advanced cancers. Better survival outcomes and quality of life can be



Anatomy of the masticator space, a Axial and b coronal T1W MR images show the superficial layer of the deep cervical fascia (white line) enveloping the space, the ramus of the mandible (R), masseteric muscle (M), medial pterygoid muscle (MP), lateral pterygoid muscle (LP), and temporalis muscle (T). The foramen ovale (thin arrow in b), from which the mandibular nerve passes. Also note the close relation of the space with the buccal fat pad (white dots) anteriorly, with the parotid gland (P) posterolaterally, and with the prestyloid parapharyngeal space (black dots) medially. Large white arrow (a) points to the expected location of the pterygomandibular raphe. N nasopharynx, O oropharynx

expected in properly selected surgical cases, as compared to non-surgical treatments.

The Masticator Space

It is a complex anatomic area situated posterior and above the oral cavity in the space below the temporal bone. The space contains medial and lateral pterygoid muscles, masseter muscle, ascending ramus of mandible, pterygoid plates, temporalis muscle, and neurovascular bundles arranged in multidimensional anatomy.

Fears and Challenges

Many clinicians avoid addressing these areas due to fear of major complications. The masticator space consists of various muscles, bones, and neurovascular bundles interwoven amongst each other. It requires knowledge of the precise anatomy of the region and the ability of the surgeon to work through bleeding to perform safe surgery in this area.

- 1) Preoperative assessment is difficult for these tumours because the MULTIDIMENSIONAL ANATOMY AND PERITUMORAL EDEMA makes it difficult to map the exact disease on imaging studies.
- 2) Excessive intraoperative bleeding from THE PTERYGOID VENOUS PLEXUS
- 3) The entire anatomic space lies in close proximity to the skull base and the internal carotid artery.
- 4) Surgical planes going THROUGH THE STRUCTURES of the masticator

space can cause even more bleeding. The specimen is removed in PIECEMEAL FASHION resulting in compromised oncological margins.

To improve margin control and patient safety during the resection of these advanced (T4b) oral cancers; the concept of compartmental resection (selective radical resection) has been proposed.

Concept of the Compartmental Resection

The compartmental resection approach is proposed to remove the entire anatomic unit of the masticator space in an en-bloc fashion, to achieve improved margin control at depth (the skull-base). Dissection is always followed in an anatomic facial plane around normal structures. It gives better exposure of the masticator space, as it is carried out in the broader plane around the muscles rather than through them.

This procedure gives the most radical resection possible with acceptable oncological outcomes.

Safeguard the Internal Carotid Artery

The internal carotid artery is the most important structure and should be safeguarded at any cost. Anatomically, the artery remains in the post-styloid compartment and enters the skull base posterior to the foramen ovale. The deep fascia over the carotid artery is very dense and well defined.

The injury to the artery can be prevented by remaining in the pre-styloid compartment and anterior to the foramen ovale at the skull base.

Control Bleeding from the Internal Maxillary Artery

The internal maxillary artery is the branch of the external carotid artery and it enters the compartment between the two heads of the pterygoid muscles.

This can be clamped early in the procedure, posterior to the neck of the mandibular condyle, before entering into the masticator space. This step significantly reduces bleeding during the resection.

Minimizing the Bleeding from the Pterygoid Venous Plexus:

Bleeding from the Pterygoid Venous Plexus is any surgeon's nightmare. It can be really profuse and can obscure the surgical field completely.

The compartmental surgical approach helps to go around the vascular structures and keeps the surgical plane of resection near the sphenoid bone, which eventually helps in reducing bleeding.

Hypotensive anaesthesia, keeping the blood pressure around 90/60 mmHg helps to reduce the bleeding enormously.

Structures Passing through the Foramen Ovale

The nerves entering the foramen ovale (lesser petrosal nerve and inferior alveolar nerve) are frequently removed to excise the extensive tumours involving the

masticator space.

The bleeding from the foramen ovale can be from the emissary vein connecting the cavernous sinus. The bleeding can be persistent and troublesome. To control the bleeding, we have to remove the soft tissue and bare the bony margins of the foramen ovale and apply bone wax with pressure.

Plastic and Reconstructive Surgery:

The resection of these tumours often leaves complex defects due to the loss of large volumes of bony (mandible-maxilla) and soft tissue structures. It generally requires advanced microvascular free flap reconstruction.

In a Nutshell:

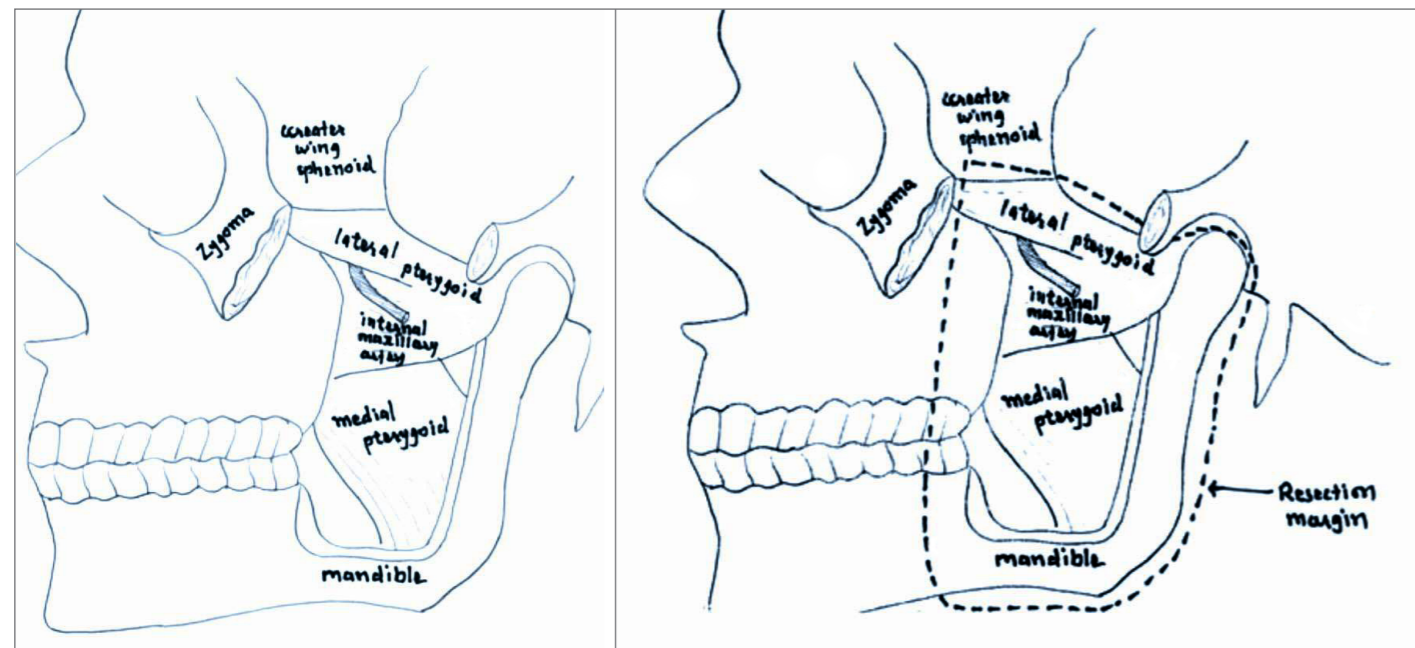
The surgery addressing the masticator space is difficult and needs skills, experience, and a multimodality team including an experienced Head and Neck surgeon for such extensive resections, a plastic surgeon to reconstruct complex defects and an experienced anaesthetist to maintain hypotensive anaesthesia.

This surgical procedure requires a learning curve but is relatively safe once technical details are understood and mastered. It can give improved survival outcomes for very advanced T4b oral cancers involving the masticator space and infratemporal fossa structures.

A Case Summary

A 34 year young male from Rajasthan presented with a very advanced (T4b staged) oral cancer of the right side, extending and involving multiple components of the masticator space. The tumour kept on growing inside him as he went on to take multiple opinions, all of which offered him a non-surgical treatment explaining grave prognosis to the patient. The whole family was extremely distressed hearing such a negative prognosis about the patient.

He was advised by one of his relatives to consult Dr. Supreet Bhatt - a Consultant, Head and Neck Cancer Surgeon and a Skull-base Cancer Specialist at Zydus Cancer Centre. Dr. Bhatt is an expert at performing complex compartmental resections for advanced oral cancers. After thorough imaging and metastatic workup, he was planned for surgical resection at ZCC. Plastic reconstruction was done by Dr. Raghuvir Solanki and team. The tumour was resected with adequate margins and base and reconstructed with a free ALT flap. The postoperative course was uneventful. Peroral feeding was allowed immediately. The patient is having satisfactory cosmetic and functional outcomes post-surgery at present.



How Treating Advanced Ovarian Cancer with Cytoreductive Surgery and HIPEC Delays Recurrence and Prolongs Overall Survival

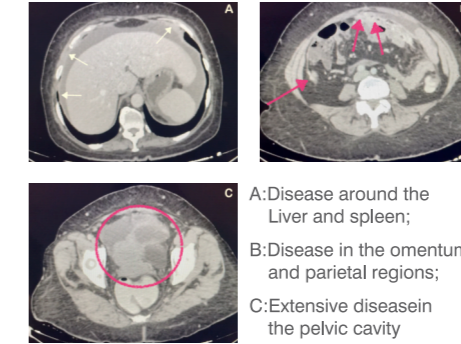


Dr. Aditi Bhatt
MS, M.ch
GI, Gynecological and Peritoneal Surface Oncologist

At Zydus, we have performed the highest number of cytoreductive surgery and HIPEC procedures in the Gujarat

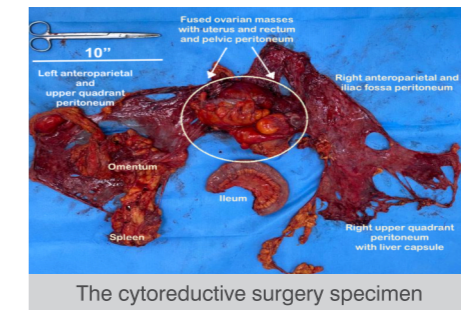
A 57-year-old lady was presented with progressive distension of the abdomen and loss of appetite. She was diagnosed with stage III-C papillary serous carcinoma of ovarian origin. The CT scan

showed bilateral solid cystic ovarian masses with extensive omental and peritoneal deposits and gross ascites. The CA-125 level was 1957 IU/L. She received 3 cycles of neoadjuvant chemotherapy with paclitaxel and carboplatin. She experienced symptomatic improvement and there was a reduction in the ascites and the size of peritoneal deposits.



The CA-125 was still 540.0 and there was disease on all peritoneal surfaces.

After prehabilitation with respiratory and physical exercises and optimization of her nutritional status, she was taken up for cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (HIPEC). Cytoreductive surgery comprised the removal of the entire parietal peritoneum (Total parietal peritonectomy), greater and lesser omentectomy, splenectomy, cholecystectomy, appendectomy, low anterior resection and resection of 15 cm of the mid-leum and the pelvic and paraaortic lymph nodes. There was no visible residual disease (complete gross resection). HIPEC was performed for 90 minutes using Cisplatin. She spent 12 days in the hospital following surgery and did not experience any major complications. On histopathological examination, there was residual disease on all peritoneal surfaces and in the lymph nodes as well.



The cytoreductive surgery specimen

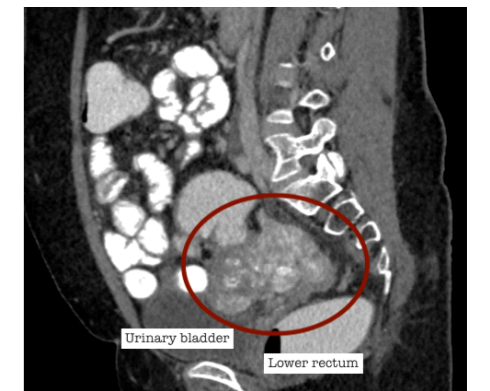
After 6 weeks of surgery, she completed three more cycles of chemotherapy with paclitaxel and carboplatin. Since the tumour was not BRCA mutated, no further treatment was planned and she was put on surveillance. She is currently free of disease at 34 months following surgery and living a normal life.

Standard Treatment for Ovarian Cancer

The standard treatment for advanced ovarian cancer (ovarian cancer that has spread to the entire abdominal cavity or peritoneal cavity) is a combination of surgery and chemotherapy. Surgery includes removal of the uterus and ovaries, the omentum and other regions bearing tumours. In this surgery, referred to as debulking surgery, limited areas of the peritoneum are removed or no peritoneum is removed. After the patient has recovered from the surgery, six doses or cycles of chemotherapy are given to the patient. In some patients, when the disease is very extensive, chemotherapy is given first and surgery is performed after 3-4 cycles of chemotherapy. The remaining cycles of chemotherapy are given after surgery.

Benefits of Cytoreductive Surgery

Chemotherapy often results in shrinkage of the tumours making it possible for the surgeon to remove them completely. But our patient did not have such a response. The fluid reduced but the tumours remained nearly unchanged. The oncologists considered putting her on a different type of chemotherapy with the hope of producing some more shrinkage and making the tumours 'removable' or 'operable'. When the tumour does not respond to one type of chemotherapy, the odds of shrinkage with a different type are even lower. Medically, she had two problems- the tumours were filling her entire pelvis (the lower part of the abdominal cavity that has the uterus, ovaries, part of the large intestine and the urinary bladder) resulting in what is known as 'frozen pelvis' and there was spread to the peritoneum too.



CT scan showing extensive disease in the pelvis which gives the appearance of a 'frozen pelvis' during surgery

By a specialized surgery called cytoreductive surgery, in which the peritoneum is removed, we were able to remove the tumour completely from the pelvic cavity. This method using 'peritonectomy' or removal of the peritoneum is an effective way to 'unfreeze' the pelvis.