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NewsLetter

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EDITORIAL

CAN YOU PREDICT SURVIVAL OF CANCER PATIENTS?

Caregivers of cancer patients are keen to know their risk of developing cancer. Cancer patients want to know their chances of recurrence. Most importantly they want to know "how much time will they live." They have apprehensions about survivors once they are not there. Main issues are risk of developing cancer, risk of recurrence and survival. Question is to find a way or algorithm which can predict their risk of recurrence and chances of survival.

Scientists have developed new strategies for the early prediction of cancer treatment outcome. As a result, Machine Learning (ML) methods have become a popular tool for medical researchers. These techniques can discover and identify patterns and relationships between them from complex datasets, while they are able to effectively predict future outcome of various cancer types. Several studies have been reported in the literature that are based on different strategies that could enable the early cancer diagnosis and prognosis. Specifically, these studies describe approaches related to the profiling of circulating miRNAs that have proven a promising class for cancer detection.Even though gene signatures can significantly improve our ability for prognosis in cancer patients, poor progress has been made for their application in the clinics.

Machine Learning (ML), a branch of Artificial Intelligence, relates the problem of learning from data samples to the general concept of inference.While applying a ML method, data samples constitute the basic component. Every sample is described with several features and every feature consists of different types of values. Furthermore, knowing in advance the specific type of data being used allows the right selection of tools and techniques that can be used for their analysis. In last two decades a variety of differentML techniques and feature selection algorithms have been widely applied to disease prognosis and prediction. In many studies gene expression profiles, clinical variables as well as histological parameters are encompassed in a complementary manner to be fed as input. ML techniques predict (i) cancer susceptibility, (ii) recurrence and (iii) survival. The success of a disease prognosis is undoubtedly dependent on the quality of a medical diagnosis; however, a prognostic prediction should take into account more than a simple diagnostic decision. The prediction of cancer outcome usually refers to the cases of (i) life expectancy, (ii) survivability, (iii) progression and (iv) treatment sensitivity. Major types of ML techniques likeArtificial Neural Network (ANN) and Decision Tree (DT) have been used for nearly three decades in cancer detection. According to the recent PubMed results regarding the subject of ML and cancer, more than 10000 articles have been published so far. A growing trend is noted in the use of other supervised learning techniques, namely Support Vector Machines (SVMs) and Batch Normalization (BN), towards cancer prediction and prognosis. In the past, the typical information used by the physicians for cancer prognosis included histological, clinical and population-based data. The integration of features such as family history, age, diet, weight, high-risk habits and exposure to environmental carcinogens play a critical role in predicting the development of cancer however these types of parameters do not provide sufficient information for making robust decisions. Molecular biomarkers, cellular parameters as well as the expression of certain genes have been proven as very informative indicators for cancer prediction. The presence of such High Throughput Technologies (HTTs) nowadays have produced huge amounts of cancer data that are collected and are available to the medical research community.

Many research groups have tried to predict the possibility of redeveloping cancer after remission.The recurrence prediction of oral squamous cell carcinoma (OSCC) has been proposed. A multiparametric Decision Support System has been suggested in order to analyze the basis of OSCC evolvement after total remission of cancer patients.A predictive model has been developed for the evaluation of survival in women that have been diagnosed with breast cancer. They compared three classification models namely SVM, ANN and SSL based on the SEER cancer database. The dataset is composed of 162,500 records with 16 key features. A class variable was also considered, namely survivability, referring to patients that had not survived and those that had survived. Among the most informative features are (i) the tumor size, (ii) the number of nodes and (iii) the age at diagnosis. By comparing the best performance of each of the three models they found that the calculated accuracy for ANN, SVM and SSL was 65%, 51% and 71% respectively. Five-fold cross validation was used for evaluating the performance of the predictive models. A relevant study was published which attempted to assess the survival prediction of non-small cell lung cancer (NSCLC) patients through the use of ANNs . Their dataset consisted of NSCLC patients' gene expression raw data and clinical data obtained from the NCI caArray database.Four clinical variables, namely sex, age, T_stage and N_stage were also considered as input variables in the ANN model. An overall accuracy of 83% was provided regarding the predictive performance of the classification scheme. Authors claimed that their model could not be applied to other cancer types except NSCLC. This assumption is considered as a major limitation in studies that the predictive models may not generalize to different cancer types.

It should be mentioned that in spite of the claims that these ML techniques can result in adequate and effective decision making, very few have actually penetrated the clinical practice. One of the most common limitations noted in the studies is the small amount of data samples. Except the data size, the dataset quality as well as the careful feature selection schemes are of great importance for effective ML and subsequently for accurate cancer predictions. With the rapid development of HTTs, including genomic, proteomic and imaging technologies, new types of input parameters need to be collected for better predictability and prognostication.

Dr. A. K. Dewan
Director - Surgical Oncology

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Mr. J. P. Dwivedi (CIO)
RGCIRC

EN - BLOC LUNG AND CHEST WALL RESECTION FOR CARCINOMA LUNG WITH NEO - RIB RECONSTRUCTION - A NOVEL TECHNIQUE

Lung cancer is an extremely complex disease in terms of its epidemiology, treatment, and prognosis. This neoplasm has the highest mortality rates in both men and women. According to the International Agency for Research on Cancer (IARC) GLOBOCAN 2018 World Cancer Report, lung cancer affects more than 2 million people a year worldwide with 1.7 million deaths. Lung cancer can be classified in several ways, the most frequent of which divides the cancers into two major groups: non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). NSCLCs have a formal indication for surgical treatment, and the preoperative evaluation should therefore be precise, seeking to recommend the best treatment approach because patient survival is closely linked to his/her tumor stage. In this time of Covid-19 pandemic, we have witnessed patients presenting late with advanced disease at presentation. This pandemic has presented a unique challenge in management of lung cancer as it mimics the symptoms due to cancer.

For adequate surgical treatment of NSCLC, en bloc resection of the affected structures is necessary, as long as the involved structures are not vital. The resection of these tumors is designed to include lung, parietal pleura, visceral pleura, and parts of the chest wall, which could include the rib cage, parts of vertebral bodies and the sternum. If there is no mediastinal lymph node or vital structure involvement, chest wall invasion does not contraindicate tumor resection because lobectomy / pneumonectomy associated with thoracoplastic surgery is considered ideal for the treatment of tumors classified as T3N0-1 M0. This procedure, however, has been associated with significant morbidity and can lead to thoracic deformity, decreased pulmonary function, and postoperative pain depending on the extent of the rib resection.

The goal of resection is **extrapleural dissection** or an **en bloc chest wall resection**. An en bloc chest wall resection is generally recommended because it provides a lower local recurrence rate and a better survival rate. Radical surgery is performed via en bloc resection of the pleural surfaces together with the endothoracic fascia, ribs, and intercostal muscles, which at times extends to more superficial tissues (muscles and fat tissue). In general, the tumors are removed with a safety margin varying with local surgical conditions. Lobectomy is performed as opposed to wedge resection. Sometimes the surgery involves resection of multiple ribs that are in close contact with the tumor. Depending on the extent of the resection, chest wall reconstruction is required using implants and prosthetic materials. This reconstruction is done in order to reduce the risk of respiratory instability by loss of part of the rib cage.

The conventional approaches of reconstruction include: prostheses and muscle / myocutaneous flaps. A sandwich of Marlex (a plastic mesh) and methyl methacrylate is most commonly used to reconstruct the chest wall. This sandwich is used for chest wall resections that involve the curved part of the chest or the sternum. An alternative is to reconstruct without the methyl methacrylate. For this method, plastic mesh, absorbable polyglactin mesh, or biologic xenografts are used. These are used primarily when the resection involves a flat area of the chest wall, such as the anterior surface between the sternum and the anterior axillary line. A myocutaneous flap is used when the chest wall resection involves a significant amount of soft tissue and especially if skin is resected and provide coverage to prosthetic material.

We are performing routinely at our institution, an innovative approach of chest wall reconstruction for primary chest wall tumors using stainless steel wire with aim to provide a semi rigid and dynamic chest wall, which is easily reproducible. We have recently modified and applied this reconstruction method for primary lung cancers with chest wall infiltration requiring rib resection and reconstruction of defect.The skeletal component of chest wall is reconstructed using stainless steel wires after ends of the ribs and cartilage are drilled using drill bit to allow passage of steel wire on both cut ends. The threaded wire is molded as per the curve of chest wall and following this the wire is tightened. The remaining wire is encircled over framework wire from one end to other, to construct neo-rib of adequate tensile strength. The procedure is repeated for other ribs. The prolene mesh is placed over the constructed neo-rib and fixed to cut adjacent soft tissue. This forms a stable and semi rigid skeletal system to maintain skeleton integrity. The mobilized muscle or myocutaneous flap may be used to cover the soft tissue and skin defect. We are hereby reporting two cases performed at RGCIRC which had progressed locally to the chest wall during covid - 19 pandemic.

Case 1: a 49-year old, a case of carcinoma right lung with right lateral chest wall infiltration. He received definitive CT-RT with immunotherapy outside previously. PET-CT suggested loco-regional mass only (figure 1) with MRI Brain was normal. He underwent postero-lateral thoracotomy with salvage right upper lobectomy with mediastinal node resection with en-bloc chest wall resection (rib 1^{st}-4^{th}) with mesh-wire reconstruction. Post-operative course was uneventful and he was discharged in a stable condition.He is currently receiving adjuvant chemotherapy.

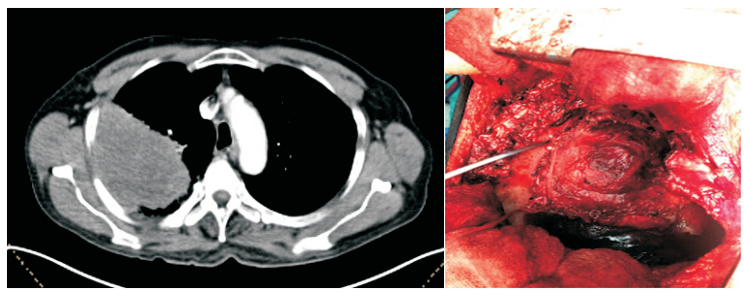
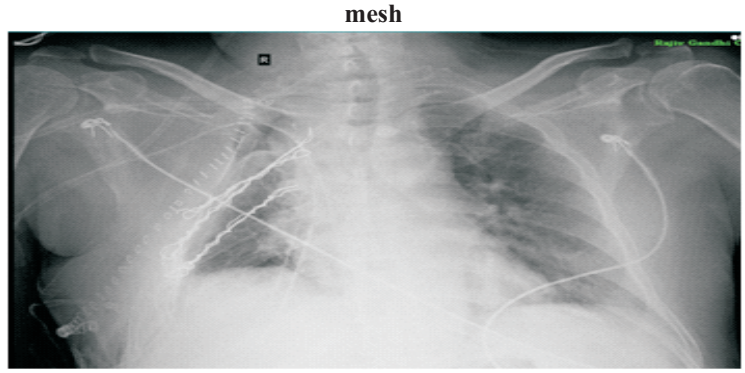


Figure 1: CT chest showing right lung mass with chest wall infiltration and post resection defect

Case 2: This 64-year old male had presented with breathlessness and cough. He was evaluated with PET-CT and EBUS which suggested localized mass with chest wall infiltration. MRI brain was normal. Mass was resected en-bloc lobectomy with rib (2^{nd} - 3^{rd}) with node dissection. He underwent neo-rib reconstruction with steel wire and mesh (figure 2). Post-operatively patient did well and was discharged on POD 7. Final histopathology was squamous cell carcinoma pT4N0. Patient received adjuvant chemotherapy for four cycles. Patient is on follow-up for six months till now and is doing fine.

Figure 2: Post resection defect reconstructed using steel wire and mesh



Post-operative chest x-ray showing reconstructed chest wall

Conclusion: En–bloc chest wall resection as part of lobectomy for lung cancer involves challenges in the respiratory mechanics which has implication in the postoperative extubation / weaning from ventilators. The Ideal prosthetic material for rib reconstruction is lacking till date and is limited by the cost. This method is an effective reconstruction tool for maintaining skeletal integrity without hampering much of respiratory mechanism.

Dr. Vineet Goel
Attending Consultant – Thoracic Surgical Oncology

Dr. L. M. Darlong
Chief of Thoracic Surgical Oncology

VIRTUAL MEETING OF AMERICAN SOCIETY OF ANESTHESIOLOGY (ASA)

RGCIRC participated in virtual meeting organized by American Society of Anesthesiology from 02nd to 05th October 2020. Dr. Anita Kulkarni, Sr. Consultant - Anesthesiology, RGCIRC delivered an oral presentation on Role of Lung Ultrasonography for Diagnosing Atelectasis in Robotic Pelvic Surgeries under the theme Respiration: Basic and Clinical Science.

The session was attended by 67 participants and well appreciated. Objectives of the study were to study the effect of VCV versus PCV, duration of surgery in development of intraoperative atelectasis in Robotic Pelvic Surgeries requiring Steep Trendelenburgh position and abdominal insuffalation. It was observed that 90% patients developed mild atelectasis in basal posterior zone bilaterally. Oxygen saturation (SpO2) <95% was not observed in any patient.

WEBINAR ON ONCOLOGY WITH ROTARY CLUB OF DELHI VASANT KUNJ & ROTARY CLUB OF DELHI ELEGANCE

RGCIRC organized a webinar in association with Rotary Club of Delhi Vasant Kunj & Rotary Club of Delhi Elegance on Saturday, 07th November 2020 through Zoom. Dr. Manish Sharma, Consultant - Medical Oncology delivered a lecture on "Tobacco: A Weapon of Mass Destruction". The session was moderated by Rtn. Mridula Khatri, Club Founder & Mentor, Rotary Club of Delhi Elegance. Dr. Sunny Malik, Consultant - Anesthesiology, Critical Care & Pain Medicine spoke on "Role of Pain & Palliative Care Specialist in Cancer Treatment" in the said virtual meeting. The webinar was very well appreciated by the gathering.

Rajiv Gandhi Cancer Institute & Research Centre, Niti Bagh, South Delhi

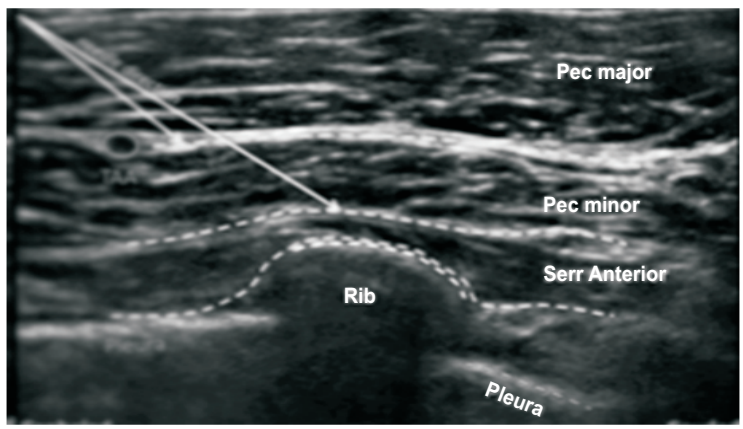
COMBINED THORACIC EPIDURAL WITH PECS BLOCK FOR BREAST CONSERVATIVE SURGERY UNDER MONITORED ANAESTHESIA CARE (MAC)

Breast cancer is very common in women and surgery remains the mainstay of treatment. Ultrasound guided regional anaesthesia techniques are coming up day by day where they are combined with general anaesthesia to reduce the opioid requirements by supplemental intra and post-operative analgesia. However, there are instances where general anaesthesia is to be avoided due to the co-morbid status of the patient. Such a case was done at Rajiv Gandhi Cancer Institute and Research Centre, Niti Bagh where these regional anaesthesia techniques (thoracic epiduralaugmented with PECS block) were used as the sole anaesthetic agent for a breast conservative surgery in a high risk interstitial lung disease case done under MAC. A thoracic epidural catheter was secured at T7-T8 intervertebral space and 10 ml of 0.5% levobupivacaine was given in aliquots. A supplemental real time ultrasound guided PECS block was given and 10 ml of 0.2% ropivacaine was instilled between pectoralis major-minor interface and 15 ml between pectoralis minor-serratus anterior muscles at 3rd - 4th intercostal space.

The breast tissue is innervated via anterior and lateral branches of the 2nd to 6th intercostal nerves that arise from the spinal nerves of the thoracic region. Apex of the axilla gets its supply from intercostobrachialis nerve which is a cutaneous branch of 2nd intercostal nerve (T2). Various muscles of anterior chest wall with their nerve supply includes pectoralis major (lateral pectoral nerve C5-C7), pectoralis minor (medial pectoral nerve C8-T1) and serratus anterior (long thoracic nerve C5-7). Lattisimusdorsi supplied by thoracodorsal nerve (C6-C8) is significant during more extensive procedures. Epidural or paravertebral block were used in the past to provide analgesia during breast surgeries. The skin overlying the axillary tail of the breast may also have cross-innervation from the intercostobrachial nerve, which is not reliably blocked by such procedures. So a combination of epidural / paravertebral with PECS block gives satisfactory analgesia for patients undergoing mastectomy with axillary clearance.

Ultrasound guided PECS I and II block was given in addition to epidural in our case where PECS I blocked the medial as well as lateral pectoral nerves and PECS II helped block the anterior cutaneous branches of the intercostal nerves 3 to 6, the intercostobrachial nerves and the long thoracic nerve thus providing complete anaesthesia for surgery.

To conclude, a combination of epidural / paravertebral along with PECS block can be used as an alternative option to general anaesthesia in high risk comorbid patients undergoing breast cancer surgeries. PECS block is an upcoming popular approach for providing analgesia in a variety of procedures ranging from simple port insertions / breast expanders to breast conservative surgeries / radical mastectomies.



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WELCOME TO RGCIRC FAMILY - DR. HIMANSHU ROHELA

Dr. Himanshu Rohela has joined as Consultant – Orthopaedic Oncology. He is an alumnus from Rajiv Gandhi University of Health Sciences, Karnataka. He completed his masters in field of Orthopaedics and later sub-specialized in field of orthopaedic oncology. He is a fellowship certified Orthopaedic Oncologist with overseas experience in management of bone and soft tissue sarcoma. He was awarded a scholar fellowship at renowned Seoul National Cancer Hospital, Seoul, South Korea where he gained further experience in 3D printing in sarcoma, Computer Assisted Navigation Sarcoma Surgery, Allograft Composite Reconstruction and Frozen Auto-grafts. He is among the few doctors in India who specialize in 3D imprinted customized patient specific implants and is the pioneer surgeon to successfully implant a 3D imprinted customized metallic pelvic bone in 24 year old young male with bone cancer. He is also the pioneer surgeon in India to combine the innovative technology of 3D printing and intraoperative navigation in bone tumour resection. He also Initiated the indo-korean continued sarcoma education on 15th August 2020 with collaboration with national cancer center south korea and SNUH, South Korea. His areas of interest include Bone tumors, Soft tissue Sarcomas, Squamous Carcinomas, Malignant Melanomas etc.

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