A cross sectional study of Chest metastasis patterns of all malignancies presented to adult chest unit, radiology department at Tikur Anbesa Specialized Hospital, Addis Ababa University, Addis Ababa, Ethiopia from October 2018 – May 2019.

Investigator: Sofia Mulugeta (MD, Radiology resident)

A thesis Submitted to The Radiology Department, College of Health Science, Addis Ababa University in Preparation for Partial Fulfillment of the Requirements for the Post Graduate Study Completion in Radiology.

Addis Ababa, Ethiopia

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Abstract

Back ground: Chest is one of the commonest metastasis site of the thoracic or extra thoracic malignancies and Pulmonary metastases have widely variable presentation on imaging and may simulate primary lung tumor or nonmalignant diseases. Therefore, it is important for the radiologist to be familiar with the full spectrum of findings to facilitate correct diagnosis and this study has tried to look for the pattern of chest metastasis.

Objective: This study aimed to assess the overall chest metastasis patterns of both thoracic and extra thoracic malignancies and their possible histologic correlation.

Methods: A prospective cross sectional study of 202 patients was done from October 2018-May 2019. A structured questionnaire was used to collect data for analysis.

Results: of the total 202 cases there are 25 primary sites and the majorities come from the following sites in the descending order esophagus (63), breast (47), lung (24), bones (14), soft tissues (10), thyroid (9), head and neck (11) and miscellaneous (24).

The commonly seen histologic variant is Squamous cell carcinoma (46 cases); majority from the esophagus followed by Adenocarcinoma (26 case**);** majority from the breast and the lung followed by sarcomas (24 cases) mainly from the bones and soft tissues and other miscellaneous histologic variants account 16cases from different sources. For the rest of cases the histology is not known.

The commonest metastatic site is found to be the lung parenchyma and air ways (accounting 120 cases with multinodular pattern being the commonest (67cases). The second is found to be the mediastinum accounting 108 cases mainly involving the lymph nodes (106 cases). The 3rd site is the pleura (58 cases) with the pleural nodule being the predominant pattern (24 cases). The last is chest wall metastasis accounting for 53 cases mainly involving the bones (26 cases).

There is statistically significant positive correlation seen between the calcific metastasis and sarcomas but no statistically significant correlation between other histologic types and lung metastasis pattern.

Conclusion: In both thoracic and extra thoracic malignancies lung parenchymal and air way metastasis is the commonest with multinodular pattern followed by lymphatic spread. The others

are mediastinal, pleural and chest wall metastasis respectively. Calcific metastasis has significant positive correlation with sarcomas.

Dedication

This research work is dedicated to those who are striving for betterment of human health by undertaking different researches in this regard.

Acknowledgements

I would like to appreciate the department of radiology, CHS, Addis Ababa University for giving me the chance to undertake this research.

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I am also thankful to my families, colleagues and friends who helped me in searching and providing the necessary literatures, as well as data.

The last but not the least I would like to appreciate the oncology department for their cooperation by providing the patient charts and sharing their work experience.

Abbreviations

A.A.....Addis Ababa

TASH.....Tikur anbesa specialized hospital

CT.....Computed tomography

CHS.....Collage of health sciences

ESR.....European society of radiology

LN..... Lymphnode

MM.....Muscle metastasis

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CHAPTER ONE

Introduction

1.1 Background

The lung is commonly involved in patients with metastatic neoplasm and pulmonary metastasis is seen in 20- 54% of extra thoracic malignancies (8,10). Typical imaging findings of pulmonary involvement include multiple round solid nodules (hematogenous metastases) and diffuse thickening of the interstitium (lymphangitic carcinomatosis). Most frequently, the classic appearance of hematogenous metastases or lymphangitic carcinomatosis and clinical history of malignant disease allow confident diagnosis. Sometimes, however, metastatic tumor presents with atypical radiologic findings and may simulate other conditions. Knowledge of the patient's medical history can help avoid diagnostic confusion, however, definitive diagnosis may require biopsy. (7,8)

Because the lungs are the most frequently affected target organs for metastatic disease, their assessment is of paramount importance in the management of oncologic patients. While plain chest radiography is the first line standard modality for detection and monitoring, the increasing use of helical CT, and particularly multi-detector row CT, as the most sensitive imaging technique in the identification of metastases has already made its impact on innovative patient care. (3)

Computed tomography (CT) has significantly altered the clinical practice of medicine, particularly in the diagnosis, staging, and treatment of cancer. It may provide a baseline for further treatment decisions and results for following the course of pulmonary nodules in patients for whom watchful waiting. (6)

1.2. Statement of the problem and significance of the study

The majority of patients with solid malignancies die from metastatic burden. However, our current understanding of the mechanisms and resulting patterns of dissemination is limited. In solid malignancies, not the primary tumor but metastatic spread and systemic disease account for approximately 90% of cancer-related deaths and the lung is commonly involved next to liver and lymph nodes. (1)

Pulmonary metastases have widely variable presentation on imaging and may simulate primary lung tumor or nonmalignant diseases. Therefore, it is important for the radiologist to be familiar with the full spectrum of findings to facilitate correct diagnosis. (7)

So this study is believed to provide the information on the patterns of chest metastatic involvement of the commonly seen malignancies of human body. So that the discrepancy to the accepted theories can be easily compared and most importantly the possible surgical planning or other modalities of treatment can be suggested.

Literatures on this area has never been done in our country and I didn`t found a single study which asses the overall metastasis pattern of malignancies of human body other than individual study like the breast cancer metastasis pattern done in Canada from1975- 1979. So I believe this study will help as a baseline for the future studies on this area

Table 1: Incidence of pulmonary metastasis according to the site;(8)

Primary tumor	Frequency at presentation %
Choriocarcinoma	60
Melanoma	5
Testis,germcell	12
Osteosarcoma	15
Thyroid	7
Kidney	20
Head and neck	5
Breast	4
Bronchus	30
Colorectal	<5
Prostate	5
Bladder	7
Uterus	<1
Cervix	<5
Pancreas	<1
Esophagus	<1
Stomach	<1
Ovary	5
Hepatoma	<1

CHAPTER TWO

2.1. Literature review

Pulmonary metastases have widely variable presentation on imaging and may simulate primary lung tumor or nonmalignant diseases. Therefore, it is important for the radiologist to be familiar with the full spectrum of findings to facilitate correct diagnosis. (7)

In patients with known primary malignancies, the appearance of multiple bilateral pulmonary nodules is highly indicative of metastatic disease and obviates the need for further diagnostic procedures. (3)

Apart from malignant disease, the differential diagnosis of single or multiple pulmonary nodules in patients with known malignancies should include pulmonary nodules of benign origin. The list of differential diagnosis for benign nodules is long and includes granuloma, sterilized metastases, infection (such as invasive aspergillus and candidiasis), and the proliferation of intrapulmonary lymph nodes. If a reasonable possibility exists that a new nodule may represent benign disease, histopathological proof can definitely influence patient management. (3)

Metastasis reach to the lung through five different ways hematogenous, lymphatic, spread with in the pleural space, endo-bronchial spread, or direct invasion of the lung. (8)

Hematogenous spread is most frequently seen in tumors with a venous drainage directly into the lung, including malignancies of the head and neck, thyroid, adrenals, kidneys, testes, melanoma, and osteosarcoma. Diffuse miliary seeding (medullary carcinoma of the thyroid), large singular metastases (choriocarcinoma, melanoma, and hypernephroma), calcification of metastases (osteosarcoma, adenocarcinoma, and secondary to chemo- and radiation therapy), and cavitation of pulmonary metastases (squamous cell carcinoma of the head and neck and from the genitourinary tract in women) are typical features. (3)

Lymphangitic carcinomatosis(most commonly tumors of the lung, stomach, breast, pancreas, uterus, rectum and prostate). The mechanisms of metastatic involvement of the lymphatics include ante grade lymphatic invasion through the diaphragm and/or pleural surfaces, and retrograde lymphatic spread from hilar nodal metastases. (3)

Macroscopically evident endo bronchial metastases (advanced malignant breast, kidney, colon, rectum, or pancreatic disease) have a low incidence and are radiographically identified in the major airways in 2–5% of patients who are dying from solid tumors. (3). A literature was revised to describe how frequent extra pulmonary tumors have been reported to metastasize to the end bronchial epithelium and English literatures were searched from 1962- 2002 and endo bronchial metastasis were reported in 204 cases from 20 different extra pulmonary tumors usually cancers of breast, kidney, colorectal, uterine, cervix, sarcomas, and skin. (14)

Metastatic pleural involvement is the most common pleural malignancy and the predominant underlying primary diseases are bronchogenic carcinoma (40%), breast carcinoma (20%), and lymphoma (10%) followed by gastrointestinal and genitourinary malignancies.(12).Metastatic seeding to the pleura frequently occurs, due to hematogenous dissemination with extension to the pleura in lymphangitic spread, or originating from established hepatic metastases. Radiologically, pleural metastases may appear as nodules or plaque like formations on plain films and CT scans. Malignant pleural effusions, observed in up to 42% of cases, most commonly arise from primary tumors of the lungs, the breast and the ovaries, and from lymphoma. (3)

The most frequent manifestation of metastatic pleural involvement is pleural effusion. Pleural involvement from lung cancer, with or without malignant pleural effusion, is indicative of a T4 tumor. Identification of pleural metastasis is therefore paramount and may prevent unnecessary lung surgery. (12)

Metastasis patterns to the chest upon CT evaluation could be typical (like multiple nodular, lymphangitic) or atypical (like solitary, cavitary, calcified, nodules with CT halo sign, spontaneous pneumothorax, endobronchial pattern, air space pattern, pleural metastasis or mediastinal involvement. (7)

Multiple nodules are usually seen in all tumors, cavitary in most squamous carcinomas, calcific pattern in sarcomas like osteosarcomas and chondrosarcomas, CT halo in choriocarcinomas and angiosarcomas, pneumothorax in sarcomas, dilated vessels within a mass in hyper vascular primaries. (7)

Metastasis patterns to the chest also may vary depending on the histologic types of the primary tumor e.g. airspace pattern of consolidation is usually seen in adenocarcinomas and cavitary metastasis in squamous carcinomas. (5)

Thoracic metastases from gynecologic malignancies exhibit various imaging patterns and are usually associated with locally invasive primary neoplasms with intra-abdominal spread. Thoracic metastases from endometrial carcinoma typically manifest as pulmonary nodules and lymphadenopathy, from ovarian and fallopian cancer often manifest with small pleural effusions and subtle pleural nodules. Thoracic metastases to the lungs, lymph nodes, and pleura may also exhibit calcification and mimic granulomatous disease. Most cervical cancers are of squamous histology, and while solid pulmonary metastases are more common, cavitary metastases occur with some frequency. Metastatic choriocarcinoma to the lung characteristically manifests with solid pulmonary nodules, while some cases exhibit the "halo" sign at CT. However, metastases from common gynecologic malignancies may be subtle and indolent and may mimic benign conditions such as intrapulmonary lymph nodes and remote granulomatous disease. Therefore, radiologists should consider the presence of loco regional disease as well as elevated tumor marker levels when interpreting imaging studies because subtle imaging findings may represent metastatic disease. (5)

There was a research done from the Departments of Medicine and Surgery, Sir Mortimer B Davis Jewish General Hospital and McGill Cancer Centre, McGill University, Montreal, Quebec, Canada from 1975- 1979 on 660 patients who was diagnosed to have breast cancer, of which 119 patients showed thoracic metastasis. The study states that breast cancer is the most common malignancy in women; 60-74% of patients dying of breast cancer have pulmonary metastases and the lung is the only site of metastasis in 21 %. (2)

According to the study chest involvement were recorded as pleural or extra pleural metastases (79 patients), mediastinal tumor (46 patients), lymphangitic carcinoma (41 patients), pulmonary nodules (34 patients), and solitary pulmonary nodule (9 patients). End bronchial metastases were present in 7 patients and multiple pulmonary tumor emboli in 2. (2)

Another study by marry shepherd in Hariefiled hospital on 104 patients are reviewed who were found to have thoracic metastases arising from distant primaries. 90 lesions were intrapulmonary and the remainder involved other thoracic structures, such as chest wall and pleura. And the

study concluded that the most common primary tumors giving rise to thoracic metastases were in the gastrointestinal and genitourinary tracts. The most common cell type was adenocarcinoma of varying differentiation. The study also followed the survival rate and in five-year survivors the interval between treatment of the primary and diagnosis of the thoracic metastasis ranged from nought to seven years. In the series as a whole the best survival was seen in patients with a primary-secondary interval of between five and 10 years. 7 of the 9 five-year survivors had their metastases resected. This is the treatment of choice in all suitable instances, whether the metastasis is in the lung or some other part of the thorax. Surgery is not, however, a prerequisite for long-term survival. Determination of the histology of the tumor and the site of the primary is essential as certain tumors respond to nonsurgical treatment. Close communication with an oncologist is therefore necessary if the most effective method of management is to be determined.

On one study done in martin Luther university, Germany on muscle metastasis patterns of 682 patients MM derived from the following malignancies: lung cancer (25.1%), gastrointestinal tumors (21.0%), and urological tumors (13.2%). Other neoplasias with MM were rare. MM were localized most frequently in the thigh muscles, the extraocular musculature, and the gluteal and paravertebral muscles. The localization of MM was different in several primary malignancies. But of the 682 patients with MM, 58(8.5%) of patents have thoracic muscular involvement. (11)

CHAPTER THREE

Objectives

3.1. General objective

- To assess the patterns of chest metastasis of malignancies of the human body

3.2. Specific objectives

- To assess the sociodemographic data of malignancies that metastasizes to the chest
- To identify the common primaries and their histologic types
- To evaluate the pattern of metastasis on the chest
- To correlate the histologic type with the pattern of lung involvement

CHAPTER FOUR

Methods and materials

4.1 Study area and period

The study was conducted at TASH, College of health science, Addis Ababa University, Addis Ababa Ethiopia. TASH, which is the only oncologic center of the country is located in the nation's capital Addis Ababa, is a largest referral as well as a main teaching hospital. The hospital provides a tertiary level referral treatment and is open 24hrs for emergency services. The study was conducted from October 2018 - May 2019 G.C.

4.2 Study design

A prospective cross sectional study was employed.

4.3 Population

4.3.1 Source population

The source population are all patients with chest CT during the study period.

4.3.2 Study population

The study population are all patients with known primary tumor and sent for chest CT evaluation for possible chest metastasis.

4.3.3 Inclusion and exclusion criteria

4.3.3.1. Inclusion criteria

- All patients with known primary tumor and chest metastatic involvement evaluated with chest CT

4.3.3.2 Exclusion criteria

- Patients with known primary tumor and who present with chest CT after treatment
- Patients with other known concomitant chest pathologies
- Patents with malignancies where the possible origin is difficult to determine like patients with leukemia/lymphoma etc.
- Patents with possible chest metastasis but the diagnostic certainty is questionable
- Patients with multiple primary tumor

4.4 Sampling technique and sample size

A non-probability, consecutive sampling was used to select the study samples**.** All patients with chest CT that has fulfilled both the inclusion and exclusion criteria during the study period was included in the study.

4.5 Data collection

Data collection was undertaken by the principal investigator using structured questionnaire. Patients' charts were reviewed to look for the histology of the primary tumor and for any surgical or medical intervention. The CT reports was reviewed and findings are recorded in the questionnaires.

4.6 Data quality control

In order to evaluate the clarity of the questionnaire and to assure the data quality, proper designing and pre-testing of the questionnaires was done on 5% of participants.

4.7 Data analysis and interpretation

The data was checked for clarity and completeness. Data was analyzed using nonparametric statistical methods with the help of SPSS version 25 software package. Then summarization and comparison of data was done.

4.8 Ethical considerations

In order to respect patient's bill of right, regulation of the hospital where the study was conducted, ethical considerations was taken in to account. Any piece of information was kept confidential by keeping anonymity of the study subjects. Written ethical clearance letters was obtained from the department.

4.9. The limitations of the study

- Metastatic involvement to the chest could be under estimated since lesions with diagnostic uncertainty are excluded because biopsy was not under taken to exclude other causes.
- Lack of properly handled patient's chart with full information. Charts for some of the patients were missing so that histologic diagnosis or presence/ absence of any therapeutic interventions were difficult to determine.
- Histologic correlation was not possible to determine for some patients since significant no of patient doesn`t have known histology.
- Some patients didn`t have conclusive histologic diagnosis.

Results

I. Sociodemographic information of the patient

There are 202 patients who are included in the study of which females constitute 115 cases (56.9%) and males account 87 cases (43.1%) from 25 different primary malignant sources. Of these 202 patients, the minimum age is 15 and the maximum age is 81 with a mean age of 46 years. The mean age for males is 49 and for females 44. The majority of patient are in the age group 31-45yrs constituting 35.6% of the sample population.

Table 1 1: Sociodemographic data of the patients

Sex of the patient	**Frequency**	**Percentage**
Male	87	43.1
Female	115	56.9
Total	202	100

Table 2 1: Age distribution of the patients

		Female		**Male**		**Total**	
		No	%	No	%	No	%
Age in years	15-30	17	48.6	18	51.4	35	17.3
	31-45	51	70.8	21	29.2	72	35.6
	46-60	41	66.1	21	33.9	62	30.6
	61-75	5	19.2	21	80.8	26	12.9
	>75	1	14.3	6	85.7	7	0.03
	Total	115	56.9	87	43.1	202	100

Figure 1 1: Histograms of the patients age distribution

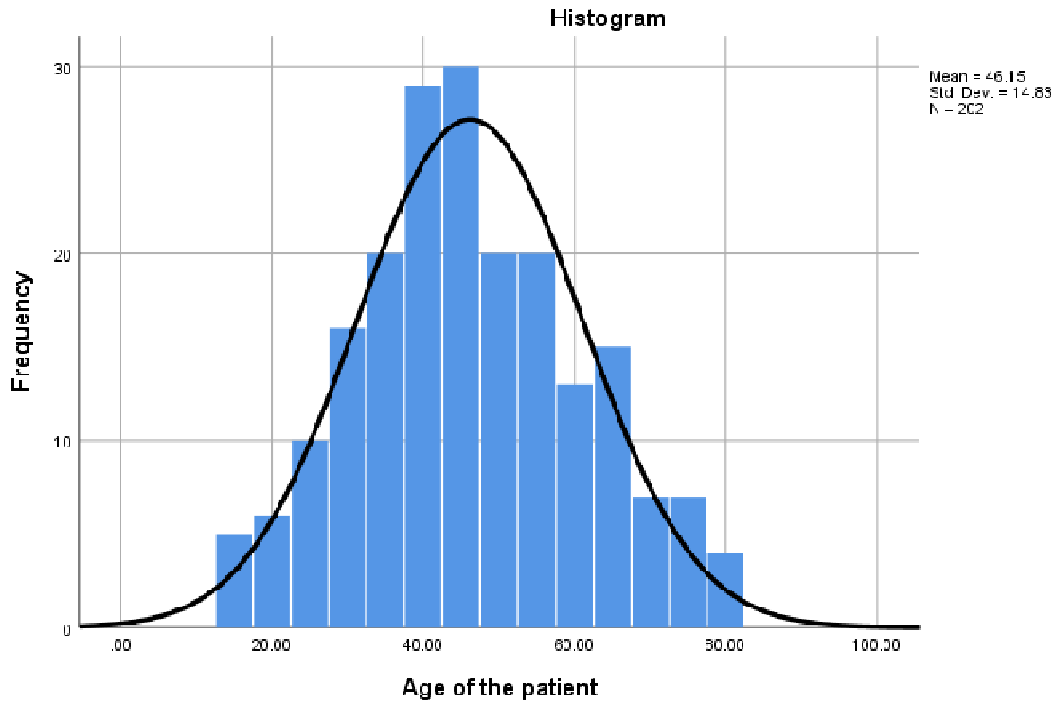
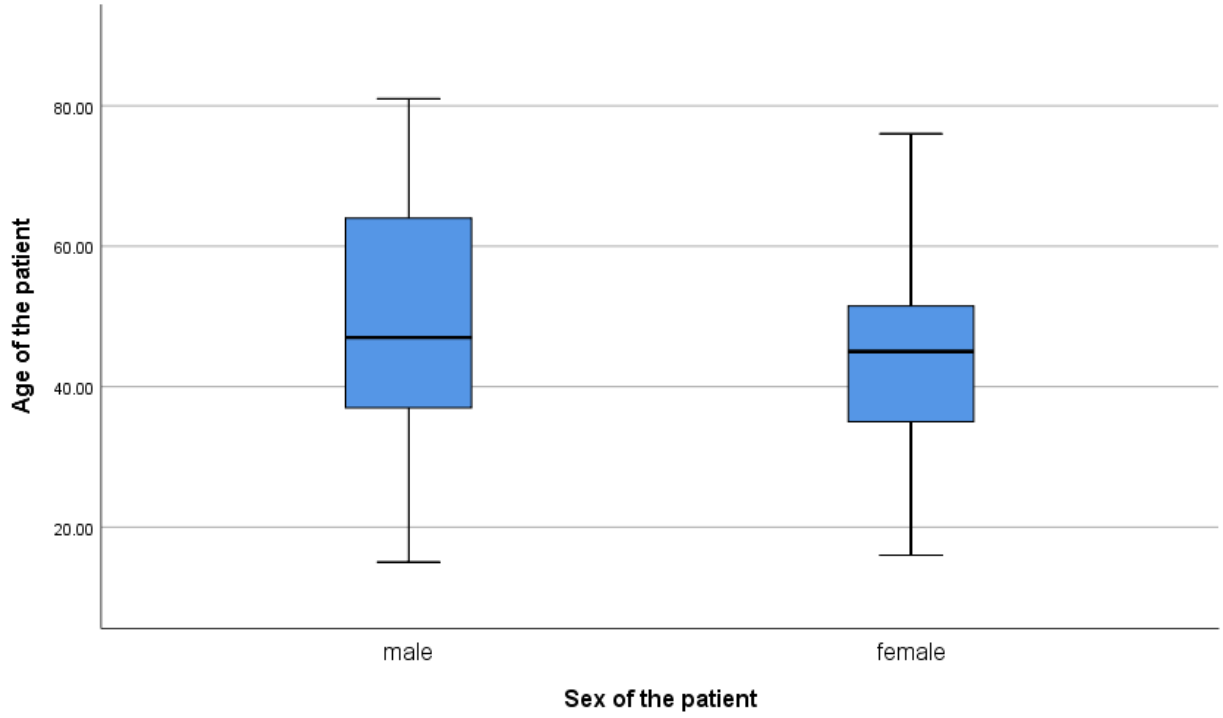


Figure 2 1: Steam and leaf plot box of comparison between males and females



II. Common primaries that has metastasised to the chest and the pattern of involvment

There are 202 primary sites that hasmetastasized to the chest and over all esophagus is thecommonest primary site accouting 63 cases followed by breast 47 cases,lung 24 cases,bones 14 cases,soft tissue 10 cases, thyroid 9 cases, nasopharynx 7 cases and others like ovary,prostate and anus each accounting 3 cases; colon, rectum,urinary bladder and cancer of unknown primary each accouting 2 cases; the rest like liver ,cervix, gall bladder,tongue,larynx,oral cavity,spleen,uterus and parotid gland have a figure of 1 each.

There are 112 cases where the histologic diagnosis are determined. Of these cases squamus cell carcinoma (46 cases) constitites the major portion followed by adeno carcinoma (26 cases)and sarcomas (24 cases) and the other 16 cases have different histologies from 11 different primary sources . The major source of the squamus cell histology is in our study is the esophagus (45/46 cases) while the major source of adenao carcinoma is the breast (14/26 cases) and lung parenchyma(8/26). Sarcomas are mainly from the bony skeleton (14/24 cases) and soft tissue (10/24 cases) in various body parts.

Table 3 1: Common primaries that has metastasized to the chest according to the study

Primary	Sex of the patient			
	Male	Female	Total	Percent
Total	87	115	202	
Esophagus	25	38	63	
Breast	2	45	47	
Lung	12	12	24	
Bone	11	3	14	
Soft tissue	8	2	10	
Thyroid	4	5	9	
Nasopharynx	7	0	7	
Anus	1	2	3	
Ovary	-	3	3	
Prostate	3	-	3	
Colon	2	0	2	
Rectum	2	0	2	
Unknown	2	0	2	
Urinary bladder	2	0	2	
Cervix	-	1	1	
Gall bladder	0	1	1	
Larynx	1	0	1	
Oral cavity	0	1	1	
Parotid gland	1	0	1	
Renal	0	1	1	
Skin	0	1	1	
Spleen	1	0	1	
Tongue	1	0	1	
Uterus	0	1	1	
Liver	1	0	1	

Table 4 1: Histologic types of the primary

Histologic type	Frequency	Percentage
SCC	46	28.8
Adeno ca	26	12.9
Sarcoma	24	11.9
Papillary ca	4	2
Follicular ca	3	1.5
Melanoma	1	0.5
HCC	1	0.5
Poorly differentiated ca	1	0.5
RCC	1	0.5
Choriocarcinoma	1	0.5
Acinar cell ca	1	0.5
Sex cord stromal tumor	1	0.5
TCC	1	0.5
Undifferentiated ca	1	0.5
Unknown	90	44.6
Total		

These 202 cases showed chest involment with different patterns and the commenest site of involment over all is the lung parenchyma and air ways accounting 120 cases, followeded by the mediatinum 108 cases, pleural 58 cases and chest wall 53 cases

Of those 120 cases who have lung parenchymal involvment multiple nodular pattern takes majority of the cases 61 cases (50.8%), followed by lymphangitic metastasis 25 cases (20.8%),solitary nodule 14 cases (11.7%), cavitary mets 9 cases (7.5%), calcified mets 8 cases (6.7%),endobronchial mets and other combined forms 2 cases(1.7%).

Of those 108 cases that has involved the mediastinum 106 cases involve the mediastinal lymphnodes,1 case the pericardium and an other one case involves both the lymphnodes and pericardium.

Of those 58 cases that has involved the pleura the majority accout pleural based nodules 24 cases (41.1%) followed by pleural effusion 20 cases (34.5%) and the others 14 cases (24.1%) involves combined pleural nodule and effusion .

Of the 54 cases that has involved the chest wall the majority 26 cases involve the thoracic bony skeleton (49.1%) followed by chest wall lymphnodes 11 cases (20.8%),soft tissues 2 cases (3.8%) and combined forms 14 cases (26.8%).

Majority of the chest metastasis figure is taken by breast ca which involves 99 cases out of the 339 parts followed by esophagus 72cases ,lung 46 cases,bones 22 cases, soft tissue 20 cases ,thyroid 17 cases ,nasopharynx 9 cases and miscellaneous sources 54 cases.

Table 5 1: pattern of chest involvment

Type of metastasis			
	Frequency	Percent	Valid Percent
Lung	120	35.4	35.4
Pleural	58	17.1	17.1
Mediastinum	108	31.9	31.9
Chest wall	53	15.6	15.6
Total	339	100.0	100.0

Table 6 1: Primary vs chest metastasis pattern

	Type of metastasis				
	Lung	**Pleural**	**Mediastinum**	**Chest wall**	**Total**
Esophagus	11	3	56	2	72
Breast	36	21	11	31	99
Lung	14	12	15	5	46
Bone	14	6	1	1	22
Soft tissue	11	3	5	1	20
Thyroid	6	3	4	4	17
Nasopharynx	5	1	1	2	9
Others	23	9	15	7	54
Total	120	58	108	53	339

Figure 3 1: Lung metastasis patterns

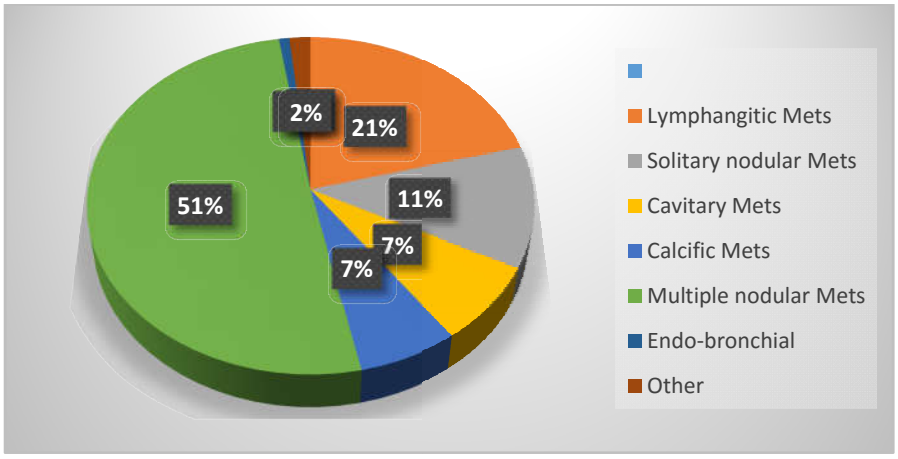


Figure 4 1: Pleural metastasis pattern

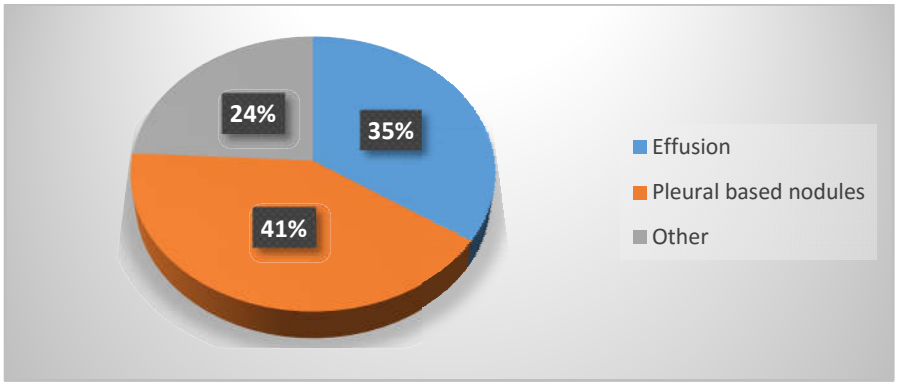


Figure 5 1: Mediastinal metastasis patterns:

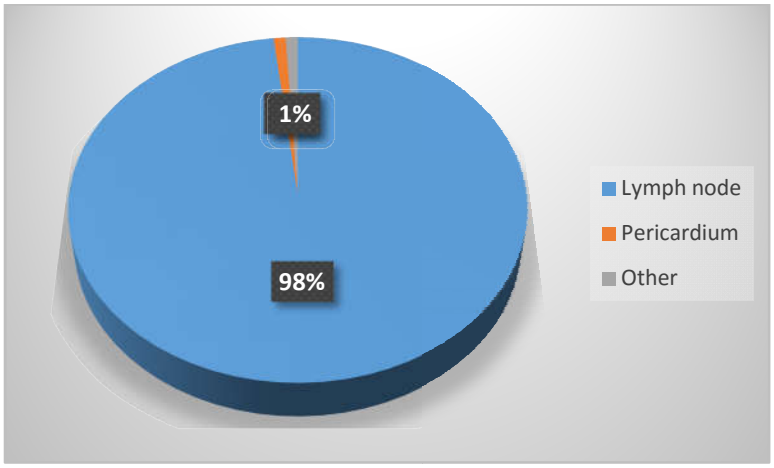
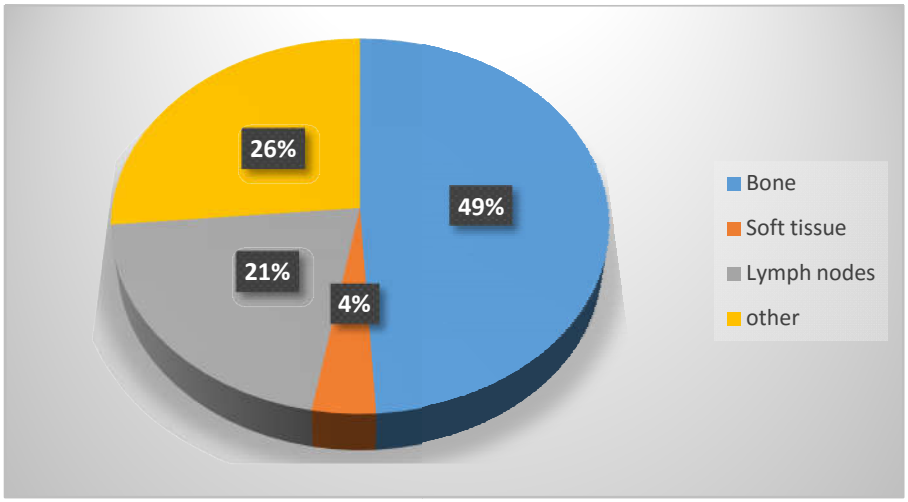


Figure 6 1: chest wall metastasis pattern:



III: Association of the lung metastasis with the histologic diagnosis of the primary

Among those who have atypical lung metastasis pattern we have found 14 solitary,9 cavitary, 8 calcific and one air way/endobronchial pattern and 7 of the 8 calcific metastasis belongs to the sarcomatous histologic group which showed statistically significant positive corelation with calcific metastasis with a p value of 0.01.

Table 7 1: Histologic diagnosis of the primary source * Lung parenchymal involvement Cross tabulation

Histologic diagnosis of the primary source * Lung parenchymal involvement Cross tabulation

		Lung parenchymal involvement							
		Multiple nodular Mets	Lymphangitic Mets	Solitary nodular Mets	Cavitary Mets	Calcific Mets	Airway	other	Total
Histologic diagnosis of the primary source	**Unknown**	24	19	7	5	1	1	0	57
	Adeno ca	9	4	1	3	0	0	1	18
	Sarcoma	13	0	2	1	7	0	1	24
	SCC	4	2	3	0	0	0	0	9
	Others	11	0	1	0	0	0	0	1
Total		61	25	14	9	8	1	2	120

Discussion

This study showed a total of 202 patients and majority are females with a male to female ratio of 1:1.3. This is because breast cancer accounts 45 cases of the total 47 cases and it is primarily seen in females.

As stated in the descriptions above among the 202 cases and 25 primary sites, the majorities come from the esophagus (63), breast (47), lung (24), bones (14), soft tissues (10), thyroid (9), head and neck (11) and miscellaneous others like ovary,prostate and anus each accounting 3 cases; colon, rectum,urinary bladder and cancer of unknown primary each accouting 2 cases; the rest like liver ,cervix, gall bladder,tongue,larynx,oral cavity,spleen,uterus and parotid gland have a figure of 1 each

On one study which is relatively similar to ours done by Mary P Shepherd, MS, FRCS, Thoracic Surgical Unit, Harefield Hospital, on 104 patients over 12years period studies a total of 18 primary sources.12 patients had metastatic sarcoma. The remainder had metastases from the gastrointestinal tract (29), from the genitourinary tract (32), from breast primaries (18), and a miscellaneous group (13) which included five instances of malignant melanoma and metastases from adrenal, laryngeal, and thyroid primaries. On the comparison study the majority of cases account the GI tract and mainly the large intestine where as in our case the majority of cases are from the GI tract but from the esophagus. Malignancies from the large bowel account small no of cases (4/202) in our study which can be explained by the larger proportion of the large bowel malignancy in the western society compared to ours. The next more frequent site of primary which is the breast and sarcomas have almost relatively similar prevalence with our study but lung carcinomas have insignificant (1/ 104 cases) proportion in the study but much larger figure (24/202) in our cases. This situation may be attributed for a not well studied high prevalence of lung carcinoma in our set up compared to the comparison study. The genitourinary primaries are relatively less common in our study than the comparison group whereas thyroid primaries have relatively similar proportion to ours. The other important findings are the head and neck primaries (11 cases) especially the nasopharyngeal ca (7 cases) is relatively common in our study whereas only 2 cases of laryngeal cancer is detected in the comparison study this can be due to a not well known increasing prevalence of NPC in our set up despite the known high prevalence in Asian population.

Knowing the pattern of metastasis has a paramount importance since the level of chest involvement has its own correlation with the survival of the patient for example generally metastasis from adjacent organ has usually better survival rate than for distant focus and some literatures said pleural metastasis is associated with poorer prognosis (16) but another study mentioned below showed a relatively better prognosis in pleural metastasis than lung parenchymal and mediastinal metastasis in breast ca patients and this was attributed to near focus of pleura to breast so that local spread might be possible (2) .

This comparison study mainly focuses on the lung metastasis pattern for which there is a surgical intervention and follow up of their survival rate was done and of those 104 cases there were 90 cases with lung parenchymal metastasis and the rest involved chest wall and pleural as well (14 cases), (NB: the study doesn`t specify the details of extra parenchymal metastasis). And our study also shows similar significant larger proportion of lung parenchymal involvement (120 cases) followed by mediastinal (108), pleural (58) and chest wall (53 cases) including the combined ones but if isolated metastasis is considered mediastinum would take the higher proportion and that is because most of the mediastinal metastasis in our study involves the lymph nodes from the esophagus that in turn is because the chest CT is the primary investigation modality for evaluation of disease extent in our set up so that the diagnostic yield would be much better compared to the other primaries where chest CT is not the primary investigation modality.

Breast ca is one of the commonest malignancy in woman and 60-74% of patients dying of breast cancer have pulmonary metastases and the lung is the only site of metastasis in 21%. On one study done in Canada on chest metastasis patterns of breast ca on 119 patients over five years period there were 79 pleural metastases,46 mediastinal metastases and 93 lung parenchymal metastasis of which lymphangitic spread has the highest figure followed by multiple nodular metastasis. Our study on 47 breast cancer cases also showed similar higher frequency of lung parenchymal involvement followed by chest wall, pleural, and mediastinal involvement respectively. But among the lung parenchymal involvement pattern multiple nodular outweighs the lymphangitic pattern (17 vs15) unlike the comparison group. This actually doesn`t mean anything since both patterns are the typical lung metastatic involvement patterns and lymphatic and hematogenous spread are comparably seen in breast cancer spread pathway.

Another study on muscle metastasis pattern of all diseases showed involvement of the thoracic musculatures in 8.5% of cases (mainly from the lung, GI and urological tumors) and our study showed muscular involvement in 0.1% of cases mainly from the thyroid.

Determining the histologic types of the primary malignancy this is also really significant as certain histologic patterns involving the chest might be treated non-surgically with better survival rate.

One thing which is observed in our study is the correlation between the atypical lung metastatic patterns and their primary histology. There are different patterns for specific histologies from different literatures as stated in the literature review and in this study there was a statistically significant (p-value <0.05) correlation seen between sarcomas and calcific metastasis which agree with the accepted scientific background. But no significant correlation between squamous cell ca and cavitary metastasis as well as adenocarcinoma and lymphangitic metastasis; this can be attributed for indeterminate histologic diagnosis of a significant number of samples resulting in insufficient sample to yield a significant correlation.

Conclusion:

There are 117 female and 87 male study populations constituting a total of 202 cases from 25 different primaries. The majority of the primaries are from esophagus, breast, lung, bones, soft tissues, thyroid and head and neck.

The commonest histology is squamous cell ca from the esophagus followed by adenocarcinoma (mainly from the lung and breast) and sarcomas from bones and soft tissues.

The commonest metastasis involvement site is the lung parenchyma followed by the mediastinum, pleura and chest wall. The major proportion of lung involvement is from the breast ca with a predominant multinodular patterns and the majority of the mediastinal involvements are lymph nodes from the esophagus. The commonest pleural involvement is pleural based nodules and the commonest chest wall involvement is bones both from the breast

There is significant statistical correlation between the sarcomas and calcific metastasis with a P-value < 0.05 but no significant correlation between the other atypical lung patterns and histologic types attributed to insufficient sample.

Recommendation:

This study has described the overall primary sources to metastasize to the chest in our set up with their metastasis patterns as a baseline but a study of individual primary patterns is recommended for detailed/better understanding.

Future study of the metastatic patterns and their survival significance would be helpful in the management of this patients so further studies in this area is recommended

Missing histology results from poor chart keeping has impaired this researched partly so that application of the electronic recording systems should be emphasized.

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Data collection format

1. Socio demographic data
   1.1 Age
   1.2 Sex
      i.) Male ii.) female

2. Presence of primary
      i.) Yes ii.).) No

If yes

   i.) Where is it?
   ii.) Mention the histologic type

3. Is there more than 1 primary
   i.) Yes
   ii.) no
4. Is there any chest involvement?
   i.) Yes ii.) No

   4.1 If yes which part is involved
      i.) Pleural and extra pleural
      ii.) Lung parenchyma and airways
      iii.) Mediastinal
      iv.) Chest wall

   4.1.1. If the lung parenchyma is involved what type of pattern does it have
      A. Multiple nodule
      B. Lymphangitic nodule
      C. Solitary nodule
      D. Cavitary nodule
      E. Calcified
      F. CT hallo
      G. Air space
      H. Endobronchail
      I. Tumor emboli
      J. Dilated vessel

   4.1.2. If the pleura is involved what type of pattern does it have
      A.) Pleural effusion B.) Sub pleural nodules C.) others

   4.1.3 If the mediastinum is involved which part is involved
      A.) Lymph nodes B.) pericardium C,) Others (specify)

   4.1.4. If the chest wall is involved which part is involved

      A.) Bones B.) Muscles C.) LNs D.) others specify

5. Does patent have biopsy from the involved chest lesion?