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# A Study on Detection of Etiological Profile, Diagnostic Examination and Treatment for Osteosarcoma in a Tertiary Care Hospital

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**ABSTRACT**
**Background:** Osteosarcoma demonstrates a bimodal age distribution and most commonly occurs in the extremities. Approximately 75% of osteosarcoma diagnoses occur in patients less than 25 years of age; the average at diagnosis is 20 years. **Aim:** The study aimed to detection of etiological profile, diagnostic examination and treatment for osteosarcoma in a tertiary care hospital. **Methodology:** The prospective observational study was carried out for a period of 6 months. The study was conducted in oncology department in a tertiary care hospital. A written and informed consent was obtained from the recruited patients. A Total of 195 patients were enrolled in the study. **Results and Discussion:** In our study 46-55 years age patients were more 77(39.485%) compared to other ages. The Etiological profile for osteosarcoma includes Rapid bone growth patients were more 95(48.71%) compared to other etiological profiles. Radiation therapy for osteosarcoma includes Yes patients were more 145 (74.35%), compare to No patients were 50 (25.64%). The Symptoms of osteosarcoma includes Bone pain patients were more 134 (68.71%), compare to Joint Swelling patients were 61 (31.28 %). The Diagnosis of osteosarcoma includes Histology of incisional biopsy patients were more 124(63.58%), compare to Radiograph patients were 71(36.41%). The Treatment for osteosarcoma includes Adjuvant chemotherapy patients were more 102(52.30%), compare to other treatment. **Conclusion:** The routine evaluation of regional lymph nodes in the staging procedure of the Osteosarcoma is therefore necessary to fully comprehend the metastatic behavior of this tumor type. An incisional biopsy of softer outer parts of the Osteosarcoma combined with a core biopsy from the calcified inner part will result in the best chances for accurate diagnosis and directing the right treatment for affected patients.
**Keywords:** Osteosarcoma, Bone pain, Radiograph, Incisional biopsy, Bone growth, Treatment

## 1. Introduction

Osteosarcoma is the most common primary malignant bone tumor, accounting for approximately 20% of all cases. Osteosarcoma demonstrates a bimodal age distribution and most commonly occurs in the extremities. Approximately 75% of osteosarcoma diagnoses occur in patients less than 25 years of age; the average at diagnosis is 20 years. However, in patients 65 years and older, osteosarcoma often occurs secondary to irradiation or Paget's disease of bone. No histopathological difference between primary and secondary osteosarcoma has been identified, but primary osteosarcoma originates within normal bone, and secondary osteosarcoma originates within bone affected by a pathologic disease process. Osteosarcoma derived from primitive osteoid-producing mesenchymal cells manifests heterogeneously; the degree of differentiation, location within the bone, and histological variation determine each osteosarcoma subtype. Each subtype varies in demographic distribution, biological behavior, and radiological appearance. High-grade conventional intramedullary osteosarcoma is the most common subtype. This subtype is a biologically complex and aggressive tumor involving a long bone's metaphysis, usually adjacent to a physis with the most significant growth, such as the proximal humerus, distal femur, or proximal tibia[1-4]. The most common presenting symptom of osteosarcoma is bone pain, initially with activity and then at rest. A reported history of a traumatic injury may or may not be present. Lesions are typically identified on radiographs of the affected limb; magnetic resonance imaging is then utilized to characterize a lesion further, and a biopsy is required for definitive diagnosis.

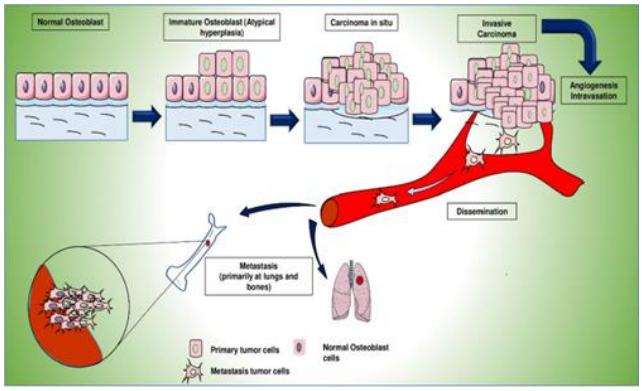


**Fig 1:** Osteosarcoma progression

### Staging

Two systems exist for the staging of bone tumors. The Musculoskeletal Tumor Society's Enneking system is used primarily by orthopedic surgeons because the tumor's anatomic

location as either intra-compartmental, which is completely contained within the bone, or extra-compartmental, extending outside of the bone, is considered. The alternative system described by the American Joint Committee on Cancer does not consider anatomic location. Instead, the AJCC uses the tumor, node, metastasis system, which considers the tumor's size and spread, which research has recognized as having significant predictive value for response to treatment and overall survival. Specifically, larger lesions tend to metastasize, so these patients may benefit from chemotherapeutic intervention, making the AJCC system more popular with oncologists. The Enneking system uses the following criteria to stage osteosarcomas[6-9]:

- **Stage IA:** Low grade, intra-compartmental tumor location, no metastasis
- **Stage IB:** Low grade, extra-compartmental tumor location, no metastasis
- **Stage IIA:** High grade, intra-compartmental tumor location, no metastasis
- **Stage IIB:** High grade, extra-compartmental tumor location, no metastasis
- **Stage III:** Any grade, any location, metastasis present

**American Joint Committee on Cancer (AJCC) Tumor, Node, Metastasis System for Staging of Primary Bone Sarcomas:** The AJCC recommends the following staging system for osteosarcomas:

- Stage IA: Low grade, <8 cm tumor size, no spread to regional lymph nodes, no distant metastasis.
- Stage IB: Low grade, >8 cm tumor size or skip lesions, no spread to regional lymph nodes, no distant metastasis.
- Stage IIA: High grade, >8 cm tumor size, no spread to regional lymph nodes, no distant metastasis.
- Stage IIB: High grade, <8 cm tumor size, no spread to regional lymph nodes, no distant metastasis.
- Stage III: High grade, discontinuous tumor involvement/"skip" lesions, no regional lymph nodes, no distant metastasis.
- Stage IVA: Any grade, any size, no regional lymph node spread, lung metastasis.
- Stage IVB: Any grade, any size, regional lymph node spread, lung or extrapulmonary metastasis.

**Physical examination findings**: Physical examination findings of osteogenic sarcoma are typically focused on the location of the primary tumor, including:

- Decreased range of motion of adjacent joint
- Pain on weight-bearing
- A palpable, tender mass
- Local lymphadenopathy
- Respiratory findings with metastatic forms

**Chemotherapy for Osteosarcoma**: Chemotherapy is also the standard of care for high-grade osteogenic sarcoma, given in the neoadjuvant and adjuvant setting. However, the ideal timing of chemotherapy (ie, preoperative versus postoperative) is unclear. Von Rosen was the first to introduce the concept of neoadjuvant chemotherapy in the management of osteosarcoma. The objective was to provide ample time to manufacture custom prostheses and to decrease tumor burden[10-14]. The advantages of neoadjuvant chemotherapy include improving the quality of life brought about by the amelioration of symptoms, treatment of micrometastatic disease, increased chances of complete resection, and assessment of response to chemotherapy.

**Primary Neoadjuvant Chemotherapy**

Regimens recommended for primary neoadjuvant chemotherapy include:

- MAP (high-dose methotrexate (HD-MTX), doxorubicin, and cisplatin) +/- Ifosfamide
- If intolerant of HD-MTX: doxorubicin, cisplatin and ifosfamide

**Relapsed or Refractory Disease Regimens**

**Regimens recommended for osteosarcoma relapse or refractory disease include:** Etoposide plus ifosfamide (most commonly used second-line regimen)

**Alternative options**

- Regorafenib
- High dose ifosfamide +/- etoposide
- Sorafenib +/- everolimus
- Cyclophosphamide and topotecan
- Docetaxel and gemcitabine
- Gemcitabine alone

**The following combinatorial regimens may be useful in specific circumstances:**

- Cyclophosphamide and etoposide
- Ifosfamide, carboplatin, and etoposide

**Radiation therapy**

Radiation therapy uses high-energy x-rays or other types of radiation to kill cancer cells or keep them from growing. Osteosarcoma is treated with external beam radiation therapy. This type of therapy uses a machine outside the body to send radiation toward the area of the body with cancer. It may be used when a small amount of cancer is left after surgery, used together with other treatments, or used as palliative therapy to relieve symptoms caused by the tumor in the bone.

**Non-pharmacological approaches for osteosarcoma**

Non-pharmacological approaches for osteosarcoma include primary treatments like surgery and supportive care measures such as physiotherapy and psychosocial support. Novel non-pharmacological methods being researched include various forms of localized ablation and the use of advanced biomaterials.

**Established Non-Pharmacological Interventions**

These approaches are part of standard multidisciplinary care for managing the disease and its effects:

**Surgery:**

This is a primary, essential component of most osteosarcoma treatment plans. The goal is to completely remove the tumor with clear margins.

**Limb-sparing surgery** removes the tumor and affected bone, which is then replaced with an endoprosthesis (artificial bone) or a bone graft from another part of the body. This is the standard procedure when feasible.

**Amputation** is performed if the tumor cannot be completely removed while maintaining a functional limb.

**Rotationplasty** is an option for some pediatric patients with tumors around the knee, where the lower leg and foot are rotated and reattached, allowing the ankle to function as a knee joint with a prosthesis.

**Physiotherapy:** Essential for post-surgical rehabilitation and managing side effects of treatment. It helps to improve strength,

mobility, and overall physical function, especially after limb-sparing surgery or amputation.

**Psychosocial Support:** Dealing with a cancer diagnosis and rigorous treatment regimen can be challenging. Support from family, friends, counselors, and social workers helps manage psychological distress and improves quality of life.

**Nutritional Management:**

Individualized nutritional counseling can help patients maintain a balanced diet, manage weight loss or other side effects, and meet their specific energy and nutrient needs during treatment.

**Exercise Therapies:** Professionally guided exercise programs (aerobic, resistance, yoga) can effectively manage cancer-related fatigue (CRF) and improve physical function.

**Emerging,Investigational Non-Pharmacological Approaches**

Current research is exploring innovative methods, often in combination with existing therapies:

**Ablation Techniques:** Minimally invasive methods for local tumor control or metastasis treatment, often used when surgery is not possible.

**Radiofrequency Ablation (RFA):** Uses high-energy waves to kill cancer cells.

**High-Intensity Focused Ultrasound (HIFU):**

Uses focused ultrasound waves to heat and destroy tumor tissue.

**Cryoablation:** Uses extreme cold to destroy tumor cells.

**Biomedical Materials and Nanotechnology:**

Advanced materials, such as drug-loaded hydrogels and scaffolds, are being investigated for direct application at the surgical site to kill residual cancer cells and promote bone regeneration.

**Photodynamic Therapy (PDT):**

Uses a photosensitizer drug and a specific type of light to produce an anti-tumor effect. This is being explored as a potential new treatment method.

**Immunotherapy:**

While many immunotherapies involve pharmacological agents (like checkpoint inhibitors), the approach of using the body's own immune system to fight cancer is a non-traditional strategy in a non-pharmacological sense. This includes exploring cell therapies like CAR-T cells and tumor-infiltrating lymphocytes (TILs), though these are still largely in the clinical trial phase.

## 2. Methodology

**Study Design**: It was Prospective observational study.

**Study Period**: The Present study was conducted for a period of six months.

**Study site**: The Present study was conducted in oncology department in a tertiary care hospital.

**Sample size:** It was 195 Patients.

**Inclusion criteria**

- Patients with age of more than 18 years.
- Patients who are willing to give consent.
- Patients of either sex, diagnosed with osteosarcoma.
- Patients receiving treatment for osteosarcoma.

**Exclusion criteria**

- Patients below 18 years.
- Patients who were not willing to join in the study.
- Special population including pregnant women and lactating women.
- Psychiatric abnormalities.

**Institutional ethics committee (IEC) consideration:**

The research protocol was submitted to ethical committee and ethical Committee was permitted to perform the research work in the selected department of a tertiary care hospital.

**Patient data collection and management:**

The data collection form contains information regarding age, sex, diagnosis, past medical history, medication history, laboratory data, and diagnosis, dose and frequency of administration and duration of therapy was collected from the patients treatment chart.

**Statistical analysis:** The data was represented as percentages. The $P<0.05$ was considered to indicate a statistically significant difference.

## 3. Results

**Table 1: Age**

| S.No | Age | Total N=195 | Percentage (%) |
|---|---|---|---|
| 1. | 20-25 | 35 | 17.94 |
| 2. | 26-35 | 26 | 13.33 |
| 3. | 36-45 | 57 | 29.23 |
| 4. | 46-55 | 77 | 39.48 |
| | **Total** | **195** | |

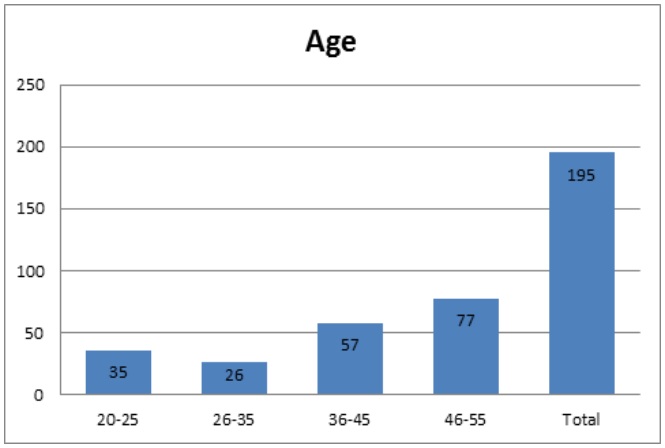


**Figure 1: Age**

**Table 2: Gender**

| S.No | Gender | Total N=195 | Percentage (%) |
|---|---|---|---|
| 1 | Male | 122 | 62.56 |
| 2 | Female | 73 | 37.43 |
| | **Total** | **195** | |

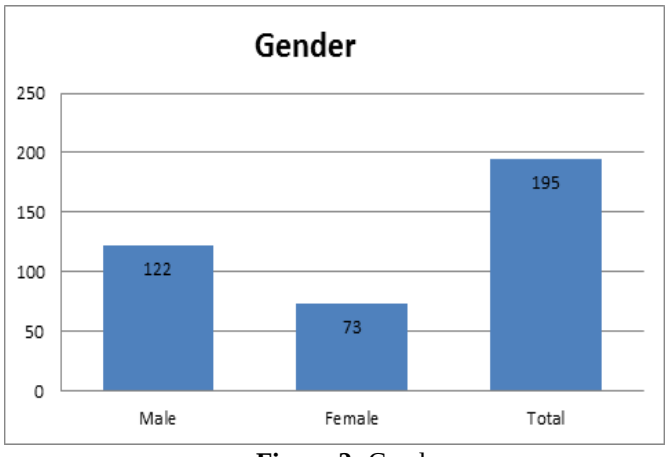


**Figure 2:** Gender

**Table 3:** Residential status

| S.No | Residential status | Total N=195 | Percentage (%) |
|---|---|---|---|
| 1 | Rural | 89 | 45.64 |
| 2 | Urban | 106 | 54.35 |
| | **Total** | **195** | |

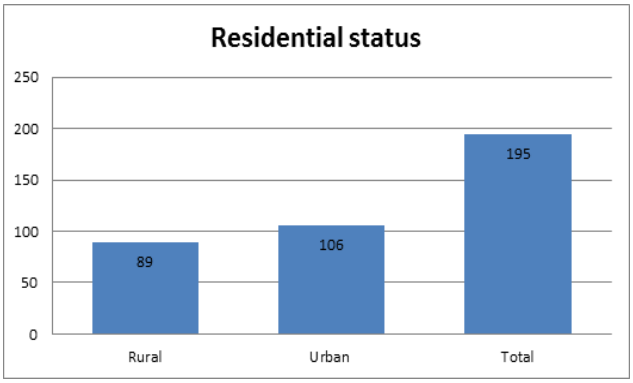


**Figure 3:** Residential status

**Table 4:** Etiological profile for osteosarcoma

| S.No | Etiological profile | Total N=195 | Percentage (%) |
|---|---|---|---|
| 1. | Family history of ostosarcoma | 45 | 23.07 |
| 2. | Rapid bone growth | 95 | 48.71 |
| 3. | Bone diseases | 55 | 28.20 |
| | **Total** | **195** | |

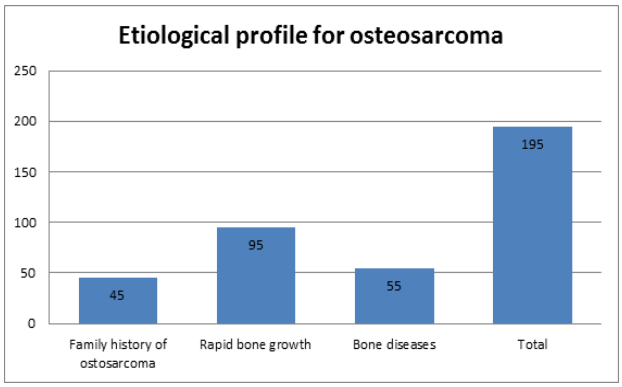


**Figure 4:** Etiological profile for osteosarcoma

**Table 5:** Stage of osteosarcoma

| S.No | Stage of osteosarcoma | Total N=195 | Percentage (%) |
|---|---|---|---|
| 1. | Localized | 50 | 25.64 |
| 2. | Regional | 55 | 28.20 |
| 3. | Distant | 90 | 46.15 |
| | **Total** | **195** | |

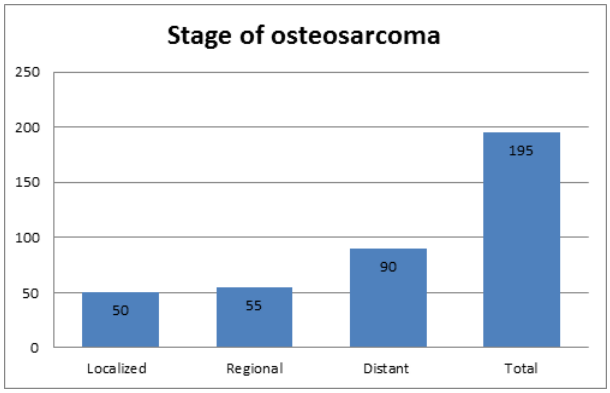


**Figure 5:** Stage of osteosarcoma

**Table 6: Grade of osteosarcoma**

| S.No | Grade | Total N=195 | Percentage (%) |
|---|---|---|---|
| 1. | Moderate | 65 | 33.33 |
| 2. | Poor | 85 | 43.58 |
| 3. | Undifferentiated | 44 | 22.56 |
| | **Total** | **195** | |

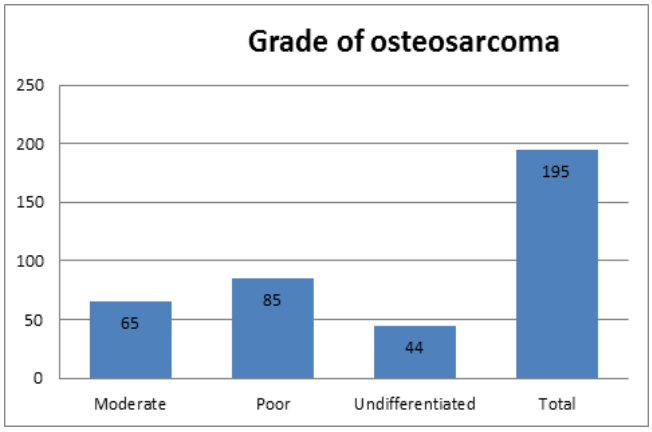


**Figure 6:** Grade of osteosarcoma

**Table 7:** Tumor size (mm) of osteosarcoma

| S.No | Tumor size (mm) | Total N=195 | Percentage (%) |
|---|---|---|---|
| 1. | <50 | 44 | 22.56 |
| 2. | 50-99 | 99 | 50.76 |
| 3. | 100-119 | 52 | 26.66 |
| | **Total** | **195** | |

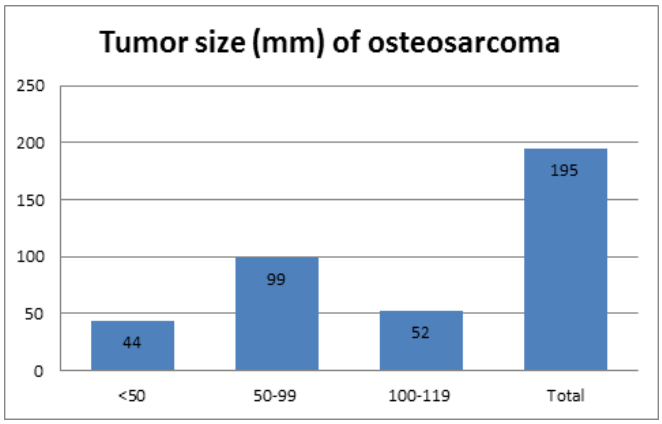


**Figure 7:** Tumor size (mm) of osteosarcoma

## 4. Discussion

- In our study 46-55 years age patients were more 77(39.485%) compared to other ages.
- In our study Male patients were more 122 (62.56%) compared to Female patients were 73(37.43 %).
- In our study urban patients were more 106 (54.35%) compared to Rural patients were 89 (45.64%).
- The Etiological profile for osteosarcoma includes Rapid bone growth patients were more 95(48.71%) compared to other etiological profiles.
- Distant stage of osteosarcoma patients were more 90(46.15%) compared to other stage of osteosarcoma.
- Poor grade of osteosarcoma patients were more 85(43.58%) compared to other grade of osteosarcoma patients.

- 50-99 Tumor size (mm) of osteosarcoma patients were more 99(50.76%) compared to other tumor sizes[15].
- The Primary site of osteosarcoma includes Upper limb osteosarcoma patients were more 102(52.30%), compared to Lower limb osteosarcoma patients were 93(47.69%).
- Histologic type of osteosarcoma includes Chondroblastic osteosarcoma patients were more 62 (31.79%) compared to other histologic type of osteosarcoma.
- Surgery for osteosarcoma includes yes patients were more 145( 74.35%), compare to No patients were 50(25.64 %).
- Surgery type for osteosarcoma includes Amputation surgery type patients were more 85(43.58%) compare to other surgeries[16-17].
- Radiation therapy for osteosarcoma includes Yes patients were more 145 ( 74.35%), compare to No patients were 50 (25.64%).
- The Symptoms of osteosarcoma includes Bone pain patients were more 134 (68.71%), compare to Joint Swelling patients were 61 (31.28 %).
- The Diagnosis of osteosarcoma includes Histology of incisional biopsy patients were more 124(63.58%), compare to Radiograph patients were 71(36.41%)[18-22].
- The Treatment for osteosarcoma includes Adjuvant chemotherapy patients were more 102(52.30%), compare to other treatment[23-24].

## 5. Conclusion

- In our study 46-55 years age patients were more 77(39.485%) compared to other ages. The Etiological profile for osteosarcoma includes Rapid bone growth patients were more 95(48.71%) compared to other etiological profiles.
- Histologic type of osteosarcoma includes Chondroblastic osteosarcoma patients were more 62 (31.79%) compared to other histologic type of osteosarcoma. Surgery type for osteosarcoma includes Amputation surgery type patients were more 85(43.58%) compare to other surgeries[25].
- The routine evaluation of regional lymph nodes in the staging procedure of the Osteosarcoma is therefore necessary to fully comprehend the metastatic behavior of this tumor type. An incisional biopsy of softer outer parts of the Osteosarcoma combined with a core biopsy from the calcified inner part will result in the best chances for accurate diagnosis and directing the right treatment for affected patients.

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## Conflict of Interests

The authors declare no conflict of interest

**Ethics Approval**: Not applicable

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## AI Tool Declaration

The authors declare that no AI and related tools are used to write the scientific content of this manuscript.

## Data Availability

Data will be available on request

## 6. References

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