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Analysis Report for Bone Tumors

Introduction

This report summarizes the findings found from the analysis of the "Bone_Tumor" dataset. Included in the dataset is information about patients with bone tumors, including demographic details, tumor characteristics, treatments, and statuses of patients.

Data Summary

The dataset contains 500 rows and 9 columns. Each row represents a patient and consists of the following characteristics:

- Patient ID
- Sex
- Age
- Tumor Grade
- Histological Type
- MSKCCTYPE
- Primary Tumor Site
- Status
- Treatment

In the summary statistics of the dataset, we find that the average patient is approximately 55.40 years. The minimum age is 17 and the maximum age is 83, giving a wide range of ages.

Treatment Analysis

A key part of this analysis is focused on the survival rates associated with different treatments. The analysis categorizes the patients based on their treatments and determines the survival rates for three categories: Alive with Disease (AWD), Dead (D), and No Evidence of Disease (NED).

As seen in Figure 1 (see page 3), the survival rates, in percentages, for the treatments are as follows:

- Radiotherapy + Surgery: AWD (6.14%), D (20.48%), NED (73.38%)
- Radiotherapy + Surgery + Chemotherapy: AWD (62.24%), D (20.98%), NED (16.78%)
- Surgery + Chemotherapy: AWD (7.81%), D (79.69%), NED (12.50%)

We can see from this evaluation that Radiotherapy + Surgery gave the highest rate for No Evidence of Disease and Surgery + Chemotherapy gave the highest rate of Death. It is also worth mentioning that adding Chemotherapy as a treatment to Radiotherapy + Surgery keeps the Death rate relatively the same, but drastically increases the rate of Alive with Disease and decreases No Evidence of Disease.

Primary Tumor Site Analysis

The distribution of primary tumor sites highlights the prevalence of tumors in specific locations. The dataset includes the following sites (As seen in Figure 2, page 3):

- Left thigh (152 cases)

- Right thigh (135 cases)
- Right buttock (72 cases)
- Parascapular (39 cases)
- Left biceps (36 cases)
- Left buttock (36 cases)
- Right parascapular (30 cases)

From this, we can see that the thighs are the most common site for tumors. An interesting observation to this is that the left thigh had the most cases. However both the right thigh and right buttock are the second and third most common sites, while the left buttock is nearly the least common. This is an interesting correlation because it can be hypothesized that the right leg (207 total cases for this area) in general can have a higher risk of bone tumors than the left leg (188 total case for the area).

**Sex and Histological Type Analysis**

The final part of this analysis comprised of the examination in the relationship between gender and histological types. Notably, leiomyosarcoma exhibited a higher prevalence among females, hinting at potential gender-related factors in its occurrence. On the other hand, myxofibrosarcoma showcased a higher incidence in males. A third observation was found where the histological types that were more common were female based and the types that were more rare were male based. (See Figure 3)

Conclusion and Results

The analysis of the "Bone_Tumor" dataset has shown some important aspects on the characteristics of bone tumors and its correlation with patient types. In this study, we have found that the choice of treatment significantly affects patient survival. Notably, Radiotherapy + Surgery showed the highest rate of patients achieving No Evidence of Disease, while Surgery + Chemotherapy was associated with the highest mortality rate. The distribution of primary tumor sites revealed interesting trends, with the left thigh being the most common location for tumors, but the right leg, as a whole, encompassing a bigger range. Moreover, the exploration of gender-related patterns in histological types uncovered potential associations that merit further investigation. While the data could benefit from further analysis with more characteristics to the set, the insights found can contribute to a better understanding of bone tumors and offer valuable awareness for future research.

(Figure 1)

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Treatment Survival Rates (%):
Status                                          AWD          D         NED
Treatment
Radiotherapy + Surgery                      6.143345  20.477816  73.378840
Radiotherapy + Surgery + Chemotherapy      62.237762  20.979021  16.783217
Surgery + Chemotherapy                      7.812500  79.687500  12.500000
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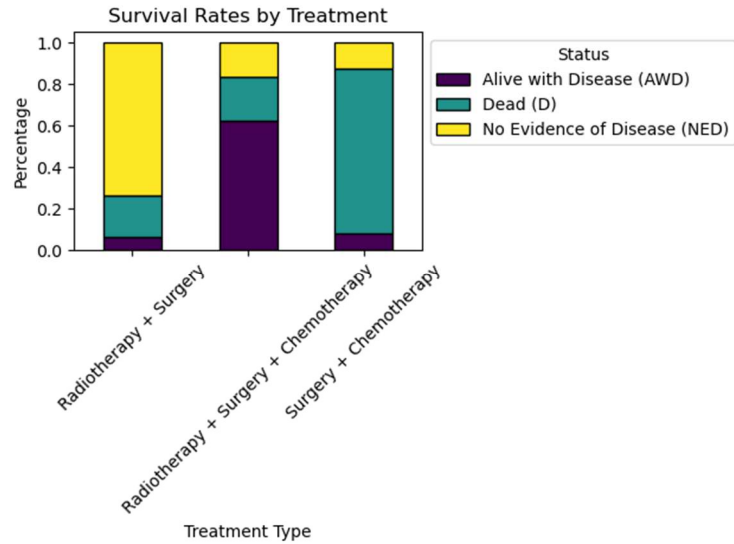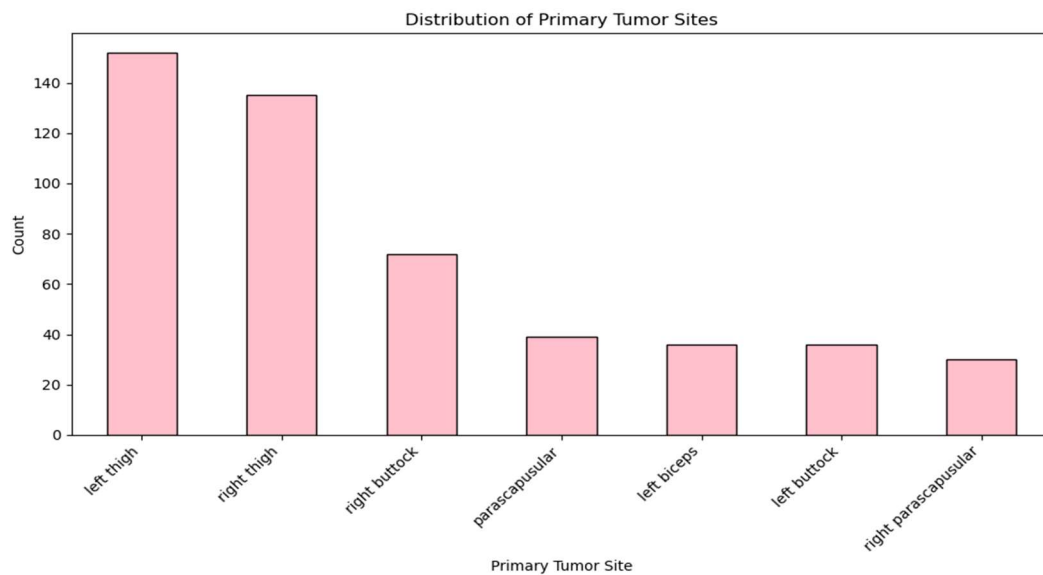

(Figure 2)

```
Primary Tumor Site Distribution:
left thigh              152
right thigh             135
right buttock            72
parascapusular           39
left biceps              36
left buttock             36
right parascapusular     30
```


(Figure 3)

```
Types of Cancer by Gender:
Sex                                              Female   Male
HistologicalType
epithelioid sarcoma                                  11      4
leiomyosarcoma                                       35      8
malignant solitary fibrous tumor                     26      3
myxofibrosarcoma                                     18     22
myxoid fibrosarcoma                                   7     20
pleiomorphic leiomyosarcoma                          80     24
pleiomorphic spindle cell undifferentiated            5     24
pleomorphic sarcoma                                  10     11
poorly differentiated synovial sarcoma                9     15
sclerosing epithelioid fibrosarcoma                  23     10
synovial sarcoma                                     61     12
undifferentiated - pleiomorphic                      11     23
undifferentiated pleomorphic liposarcoma              4     24
```


Histological Types by Gender