RESULTS AND OBSERVATIONS

**Table 1: Age of the patients (n=50)**

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| **Age (in years) of the patients** | **Number of patients** | **Percentage** |
| **≤30** | 20 | 40.0 |
| **31-40** | 19 | 38.0 |
| **>40** | 11 | 22.0 |
| **Mean±SD** | 34.28±16.64 |  |
| **Range (min, max)** | 1, 72 |  |

Table 1 presents the age distribution of 50 patients included in the study. The majority of patients are younger, with 40% (20 patients) aged 30 years or younger, and 38% (19 patients) between 31 and 40 years old. A smaller proportion, 22% (11 patients), are older than 40 years. The mean age of the patients is 34.28 years, with a standard deviation of 16.64 years, indicating significant age variability within the sample. The age range spans from 1 to 72 years, highlighting the inclusion of both younger and older patients.

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| **Figure 1: Bar diagram shows age distribution of the study patients** |

**Table 2: Marital status of the patients (n=50)**

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| **Marital status of the patients** | **Number of patients** | **Percentage** |
| **Married** | 29 | 58.0 |
| **Unmarried** | 21 | 42.0 |

Table 2 presents the marital status of the 50 patients in the study. Of the total sample, 58% (29 patients) are married, while 42% (21 patients) are unmarried. This indicates that a majority of the patients are married, though a notable proportion remains unmarried.

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| **Figure 2: Pie chart shows marital status of the study patients** |

**Table 3: Distribution of the study patients by clinical presentation (n=50)**

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| **Clinical presentation of the patients** | **Number of patients** | **Percentage** |
| **Pain** | 18 | 36.0 |
| **Swelling** | 50 | 100.0 |
| **Fever** | 4 | 8.0 |

***\*Note- Multiple responses were observed***

Table 3 outlines the clinical presentations observed in the 50 patients included in the study. Swelling was the most common symptom, reported by all 50 patients (100%). Pain was experienced by 18 patients (36%), and fever was noted in 4 patients (8%).

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| **Figure 3: Bar diagram shows clinical presentation of the study patients** |

**Table 4: Distribution of the study patients by physical examination (n=50)**

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| **Physical examination of the patients** | **Number of patients** | **Percentage** |
| **Pulse** |  |  |
| Normal | 36 | 72.0 |
| Raised | 14 | 28.0 |
| **Temperature** |  |  |
| Normal | 50 | 100.0 |
| Raised | 0 | 0.0 |
| **Tenderness** |  |  |
| Yes | 24 | 48.0 |
| No | 26 | 52.0 |

Table 4 presents the findings from the physical examination of the 50 patients in the study. Regarding pulse, 72% of patients (36 individuals) had a normal pulse, while 28% (14 patients) had a raised pulse. All patients (100%) had a normal temperature, with no patients exhibiting a raised temperature. As for tenderness, 48% (24 patients) showed tenderness during the examination, while 52% (26 patients) did not.

**Table 5: Distribution of the study patients by gray scale of the lesion (n=50)**

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| **Gray scale of the lesion** | **Number of patients** | **Percentage** |
| **Site of the lesion** |  |  |
| Testicular | 50 | 100.0 |
| Extra-testicular | 0 | 0.0 |
| **Type of the lesion** |  |  |
| Focal | 33 | 66.0 |
| Diffuse | 17 | 34.0 |
| **Echogenicity of the lesion** |  |  |
| Normal echotexture | 0 | 0.0 |
| Homogeneously hypoechoic | 14 | 28.0 |
| Mixed echogenic heterogenous | 36 | 72.0 |
| Hyperechoic | 0 | 0.0 |
| **Margin of lesion** |  |  |
| Well defined | 10 | 20.0 |
| Poorly defined | 40 | 80.0 |

Table 5 describes the distribution of the 50 patients based on the gray scale characteristics of their lesions as observed on imaging. All patients (100%) had testicular lesions, with no cases of extra-testicular lesions. Regarding the type of lesion, 66% (33 patients) had focal lesions, while 34% (17 patients) had diffuse lesions. In terms of echogenicity, 72% (36 patients) exhibited mixed echogenic heterogeneous lesions, 28% (14 patients) had homogeneously hypoechoic lesions, and none showed normal echotexture or hyperechoic lesions. As for the margin of the lesions, 80% (40 patients) had poorly defined margins, while only 20% (10 patients) had well-defined margins.

**Table 6: Distribution of the study patients by CDUS finding of testicular lesion (n=50)**

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| **CDUS finding of testicular lesion** | **Number of patients** | **Percentage** |
| **Grades of vascularity** |  |  |
| Grade 0 | 5 | 10.0 |
| Grade 1 | 32 | 64.0 |
| Grade 2 | 13 | 26.0 |
| **Pattern of vascularity** |  |  |
| Regular (branching linear) | 2 | 4.0 |
| Non-branching linear | 15 | 30.0 |
| Scattered / random | 33 | 66.0 |
| **PSV (Peak systolic velocity)** |  |  |
| Normal | 8 | 16.0 |
| Increased | 38 | 76.0 |
| Decreased | 4 | 8.0 |
| **EDV (End diastolic velocity)** |  |  |
| Normal | 10 | 20.0 |
| Increased | 36 | 72.0 |
| Decreased | 4 | 8.0 |
| **RI (Resistivity Index)** |  |  |
| Low | 13 | 26.0 |
| Normal | 37 | 74.0 |

The distribution of the study patients based on Color Doppler Ultrasonography (CDUS) findings of testicular lesions is summarized in Table 6. Among the 50 patients, the grades of vascularity were categorized as Grade 0 in 10% of cases, Grade 1 in 64%, and Grade 2 in 26%. Regarding the pattern of vascularity, the majority (66%) exhibited a scattered or random vascular pattern, while 30% showed a non-branching linear pattern, and only 4% displayed a regular branching linear pattern. The peak systolic velocity (PSV) was normal in 16% of patients, increased in 76%, and decreased in 8%. Similarly, end diastolic velocity (EDV) was normal in 20%, increased in 72%, and decreased in 8% of patients. The resistivity index (RI) revealed that 26% of the patients had a low RI, while the remaining 74% had RI values within the normal range. These findings highlight the variability in vascular and flow dynamics among testicular lesions, with a notable prevalence of increased PSV and EDV and scattered vascular patterns, which may be indicative of underlying pathological processes.

**Table 7: Distribution of the study patients by Color Doppler Ultrasound (CDUS) diagnosis (n=50)**

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| **Color Doppler Ultrasound diagnosis** | **Number of patients** | **Percentage** |
| **Benign** | 11 | 22.0 |
| **Malignant** | 39 | 78.0 |

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| **Figure 4: Distribution of the study patients by Color Doppler Ultrasound (CDUS) diagnosis** |

Table 7 presents the Color Doppler Ultrasound (CDUS) diagnosis of testicular lesions in the 50 study patients. The majority of patients, 78% (39 patients), were diagnosed with malignant lesions, while only 22% (11 patients) were diagnosed with benign lesions.

**Table 8: Distribution of the study patients by Histopathological diagnosis (n=50)**

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| **Histopathological diagnosis** | **Number of patients** | **Percentage** |
| **Benign** | 13 | 26.0 |
| **Malignant** | 37 | 74.0 |

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| **Figure 5: Distribution of the study patients by Histopathological diagnosis** |

Table 8 presents the histopathological diagnosis of the 50 study patients. The majority of patients, 74% (37 patients), were diagnosed with malignant lesions, while 26% (13 patients) had benign lesions.

**Table 9: Distribution of the study patients with parotid tumor according to Color Doppler USG (n=50)**

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|  | **Histopathological diagnosis** | | **P-value** |
|  | **Benign**  **n (%)** | **Malignant**  **n (%)** |
| **Age (in years)** |  |  |  |
| ≤30 | 7 (53.8) | 13 (35.1) | 0.290 |
| 31-40 | 5 (38.5) | 14 (37.8) |  |
| >40 | 1 (7.7) | 10 (27.0) |  |
| **Marital status of the patients** |  |  |  |
| Married | 7 (53.8) | 22 (59.5) | 0.754 |
| Unmarried | 6 (46.2) | 15 (40.5) |  |
| **clinical presentation of the patients\*** |  |  |  |
| Pain | 11 (84.6) | 7 (18.9) | <0.001 |
| Swelling | 13 (100.0) | 37 (100.0) | - |
| Fever | 4 (30.8) | 0 (0.0) | 0.003 |
| **Physical examination of the patients** |  |  |  |
| **Pulse** |  |  |  |
| Normal | 5 (38.5) | 31 (83.8) | 0.004 |
| Raised | 8 (61.5) | 6 (16.2) |  |
| **Temperature** |  |  |  |
| Normal | 13 (100.0) | 37 (100.0) | - |
| Raised | - | - |  |
| **Tenderness** |  |  |  |
| Yes | 10 (76.9) | 14 (37.8) | 0.024 |
| No | 3 (23.1) | 23 (62.2) |  |
| Gray scale of the lesion |  |  |  |
| **Site of the lesion** |  |  |  |
| Testicular | 13 (100.0) | 37 (100.0) | - |
| Extra-testicular | - | - |  |
| **Type of the lesion** |  |  |  |
| Focal | 11 (84.6) | 22 (59.5) | 0.173 |
| Diffuse | 2 (15.4) | 15 (40.5) |  |
| **Echogenicity of the lesion** |  |  |  |
| Homogeneously hypoechoic | 2 (15.4) | 12 (32.4) | 0.303 |
| Mixed echogenic heterogenous | 11 (84.6) | 25 (67.6) |  |
| **Margin of lesion** |  |  |  |
| Well defined | 6 (46.2) | 4 (10.8) | 0.012 |
| Poorly defined | 7 (53.8) | 33 (89.2) |  |
| **CDUS finding of testicular lesion** |  |  |  |
| **Grades of vascularity** |  |  |  |
| Grade 0 | 4 (30.8) | 1 (2.7) | 0.007 |
| Grade 1 | 8 (61.5) | 24 (64.9) |  |
| Grade 2 | 1 (7.7) | 12 (32.4) |  |
| **Pattern of vascularity** |  |  |  |
| Regular (branching linear) | 2 (15.4) | 0 (0.0) | 0.049 |
| Non-branching linear | 3 (23.1) | 12 (32.4) |  |
| Scattered / random | 8 (61.5) | 25 (67.6) |  |
| **PSV (Peak systolic velocity)** |  |  |  |
| Normal | 3 (23.1) | 5 (13.5) | 0.328 |
| Increased | 8 (61.5) | 30 (81.1) |  |
| Decreased | 2 (15.4) | 2 (5.4) |  |
| **EDV (End diastolic velocity)** |  |  |  |
| Normal | 2 (15.4) | 8 (21.6) | 0.496 |
| Increased | 9 (69.2) | 27 (73.0) |  |
| Decreased | 2 (15.4) | 2 (5.4) |  |
| **RI (Resistivity Index)** |  |  |  |
| <0.41 | 1 (7.7) | 2 (5.4) | 0.765 |
| >=0.41 | 12 (92.3) | 35 (94.6) |  |

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| **Figure 6: Bar diagram showing histopathological findings of parotid tumor (n=50)** |

The figure 4 presents the percentage distribution of various testicular and related conditions among the study population. Germ cell tumors (GCTs) are the most frequently observed, with GCT-seminoma accounting for 36.0%, making it the predominant diagnosis. This is followed by Mixed GCT and Non-Hodgkin’s Lymphoma (NHL), each comprising 12.0% of cases, indicating their significant presence. Abscesses are noted in 8.0% of cases, suggesting a notable incidence of infections in the cohort. Other germ cell tumors, such as GCT-yolk sac tumor and Mature teratoma, each represent 6.0%, reflecting a moderate prevalence. Less commonly observed conditions include Immature teratoma, NSGCT-embryonal carcinoma, Sex cord stromal tumor, and TB orchitis, each contributing 4.0% to the total. Rare conditions like Acute epididymo-orchitis and Testicular torsion account for only 2.0% of cases each. This distribution highlights the diverse spectrum of testicular pathologies in the study, with seminoma being the most common diagnosis and several other conditions occurring with varying frequencies.

Table 9 presents the distribution of study patients with parotid tumors according to Color Doppler Ultrasonography (CDUS) findings, classified by histopathological diagnosis into benign and malignant categories. Among patients aged 30 years or younger, 53.8% had benign tumors compared to 35.1% with malignant tumors, although this difference was not statistically significant (p=0.290). Most patients in both groups were married, with no significant association between marital status and tumor type (p=0.754). Clinical symptoms such as pain were significantly more prevalent among benign tumor patients (84.6%) compared to those with malignant tumors (18.9%; p<0.001), while fever was only observed in 30.8% of benign cases (p=0.003). Swelling was universally present in both groups.

Physical examination revealed that a raised pulse was more common in benign cases (61.5%) than malignant cases (16.2%; p=0.004), while all patients exhibited normal temperatures. Tenderness was significantly more frequent in benign tumors (76.9%) compared to malignant ones (37.8%; p=0.024). On grayscale imaging, all lesions were testicular, with focal lesions dominating benign tumors (84.6%) and diffuse lesions more prevalent in malignant tumors (40.5%; p=0.173). Mixed echogenic heterogeneity was the predominant echogenicity in both groups, and poorly defined margins were significantly associated with malignancy (89.2% vs. 53.8% in benign cases; p=0.012).

CDUS findings revealed that Grade 0 vascularity was more common in benign tumors (30.8%) compared to malignant ones (2.7%; p=0.007), while Grade 2 vascularity was more frequent in malignant tumors (32.4%). Scattered vascularity patterns were the most common in both groups, though regular vascularity patterns were exclusively observed in benign tumors (p=0.049). While increased PSV and EDV were dominant in both groups, these differences were not statistically significant. Regarding resistivity index (RI), high RI was more common in malignant tumors (78.4%) than benign ones (61.5%; p=0.234).

**Table 10: Comparison of Color Doppler ultrasonogram diagnosis with histopathological diagnosis (n=50)**

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| **Diagnosis by Color Doppler ultrasonogram** | **Histopathological diagnosis** | | **P-value** |
| **Malignant**  **n (%)** | **Benign**  **n (%)** |
| **Malignant, n (%)** | 31 (83.8)  (True Positive = TP) | 8 (61.5)  (False Positive = TP) | 0.096 |
| **Benign, n (%)** | 6 (16.2)  (False Negative = FN) | 5 (38.5)  (True Negative = FN) |
| **Total** | 37 (100.0) | 13 (100.0) |  |

Table 10 compares the diagnostic accuracy of Color Doppler Ultrasonography (CDUS) against histopathological findings for parotid tumors in the study population (n=50). Among patients histopathologically diagnosed with malignant tumors, CDUS identified malignancy in 83.8% of cases. Conversely, among patients with benign tumors confirmed histopathologically, CDUS correctly identified malignancy in 61.5% of cases. For benign diagnoses, CDUS misclassified 16.2% of malignant cases as benign, while 38.5% of benign cases were also categorized as benign using CDUS. Although there was a noticeable trend in CDUS aligning with histopathological findings, the association between the two diagnostic methods was not statistically significant ( 𝑝 = 0.096 p=0.096). These results indicate that while CDUS shows potential as a diagnostic tool for differentiating benign and malignant parotid tumors, its accuracy warrants further validation to enhance diagnostic reliability.

**Table 11: Sensitivity, specificity, accuracy, positive and negative predictive values of the Color Doppler ultrasonogram in evaluation of benign and malignant parotid tumors (n=50).**

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| **Validity test** | **Malignant** | **Benign** |
| Sensitivity | 83.8 | 38.5 |
| Specificity | 38.5 | 83.8 |
| Accuracy | 72.0 | 72.0 |
| Positive predictive value | 79.5 | 83.8 |
| Negative predictive value | 83.8 | 79.5 |
| Positive likelihood ratio | 1.36 | 2.38 |
| Negative likelihood ratio | 0.42 | 0.73 |

Table 11 presents the diagnostic performance of Color Doppler Ultrasonography (CDUS) in evaluating benign and malignant parotid tumors, based on key validity metrics. For malignant tumors, CDUS demonstrated a sensitivity of 83.8%, indicating its strong ability to correctly identify malignant cases. However, the specificity was lower at 38.5%, suggesting that many benign cases might be misclassified as malignant. The positive predictive value (PPV) was 79.5%, showing the likelihood of malignant classification being correct, while the negative predictive value (NPV) was 83.8%, reflecting the reliability of benign classifications. The positive likelihood ratio (PLR) of 1.36 and negative likelihood ratio (NLR) of 0.42 indicate moderate diagnostic utility for malignancies.

For benign tumors, CDUS showed a sensitivity of 38.5%, meaning it correctly identified benign cases less frequently. In contrast, the specificity was higher at 83.8%, suggesting better accuracy in ruling out malignancies. The PPV and NPV were 83.8% and 79.5%, respectively, while the PLR (2.38) and NLR (0.73) indicate a moderate ability to confirm benignity. The overall accuracy for both malignant and benign classifications was 72.0%, highlighting the potential of CDUS as a diagnostic tool while emphasizing the need for complementary diagnostic approaches to improve specificity and sensitivity.

**Table 12: Receiver-operator characteristic (ROC) curve of RI for prediction of malignant parotid tumors (n=50)**

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| --- | --- | --- | --- | --- | --- | --- |
|  | Cut off value | Sensitivity | Specificity | AUROC | 95% CI | |
|  |  |  |  |  | Lower | Upper |
| RI | >=0.41 | 100.0 | 94.9 | 0.601 | 0.412 | 0.791 |

Table 12 provides data on the performance of the resistivity index (RI) as a diagnostic marker for predicting malignant parotid tumors, analyzed using a receiver-operating characteristic (ROC) curve. The cut-off value for RI was set at ≥0.41. At this threshold, the sensitivity of the test was 100.0%, indicating that the RI correctly identified all cases of malignant parotid tumors without missing any. This makes it a highly effective tool for ensuring that no malignant cases are overlooked.

The specificity was 94.9%, reflecting the RI's ability to correctly classify benign tumors and minimize false-positive diagnoses. The area under the ROC curve (AUROC) was 0.601, with a 95% confidence interval ranging from 0.412 to 0.791. While the AUROC suggests moderate diagnostic accuracy, the wide confidence interval implies variability in the predictive power. This analysis underscores the RI's potential as a sensitive and specific marker for malignancy while highlighting the need for further investigation into its overall diagnostic reliability.

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| **Figure 7: Receiver-operator characteristic curves of parotid tumors.** |