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Original Research Paper

Pathology

COMPARISON OF THERMAL ARTIFACT IN HISTOLOGICAL TURBT SPECIMEN OBTAINED USING MONOPOLAR VS BIPOLAR CAUTERY IN A TERTIARY HOSPITAL IN CHENNAI

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ABSTRACT

BACKGROUND Bladder cancer is one of the common urological malignancies. Transurethral resection of bladder tumor (TURBT) is commonly performed for the diagnosis and initial therapy of bladder cancer. Deep biopsy is essential in TURBT for proper pathologic diagnosis and for deciding the line of management either conservative or more radical treatment (1–3). Recently TURBT biopsies have been done using bipolar devices. The accuracy of the histological specimen in diagnosing and staging the bladder cancer has to be studied in comparison with conventional monopolar devices. In this study, the various thermal artifacts noted in TURBT specimens obtained by both monopolar and bipolar devices are studied histologically and compared.

METHODOLOGY Retrospective analysis of various histopathological artifacts in TURBT tissue obtained using either monopolar or bipolar energy was done in this study.28 (62.23%) of subjects underwent transurethral resection of bladder tumor using monopolar device with 1.5 % glycine as irrigant and 17(37.7%) of subjects underwent transurethral resection of bladder tumor using bipolar device with 0.9% normal saline as irrigant.

RESULT Thermal artifacts were graded both quantitatively and qualitatively according to WHO grading system. In monopolar group quantitative grade 1 artifacts were found in 14 (50%) samples, grade 2 artifacts in 10.7% and grade 3 artifacts in 4% (14.3),and zero grade i.e., without any artifacts 7(25%). Qualitative grading showed grade 1 artifacts in 15 samples (53.6), grade 2 in two samples (7.1%), grade 3 showed 10, 7% in three samples.

CONCLUSION There was no significant difference noted in both quantitative and qualitative thermal artifacts grade between monopolar and bipolar energy sources used.

KEYWORDS : Thermal artifacts, monopolar, bipolar energy, TURBT

INTRODUCTION

Bladder cancer is the 9th most common malignancy in the world. Transurethral resection of bladder tumor (TURBT) is commonly performed using conventional monopolar or bipolar devices for the diagnosis and initial therapy of bladder cancer. Though the principles of both monopolar and bipolar plasma kinetic device are similar, the path of return of current to the generator is different. As usage of bipolar device is relatively newer modality the accuracy of the histological specimen in diagnosing and staging the bladder cancer has to be studied in comparison with conventional monopolar devices. However, until the plasma kinetic device's long-term safety is determined, monopolar TURBT will continue as the first option for these patients.

AIMS AND OBJECTIVES

To assess the grades of thermal artifact in biopsy specimen following monopolar TURBT and bipolar TURBT.

To compare the grades of thermal artifact between the biopsies obtained by two modalities.

MATERIALS AND METHODS

Study design: Comparative prospective cross - sectional study of TURBT specimens

Study Centre: Govt. Stanley Medical College and Hospital.

Study duration: TURBT from August 2013 to February 2016 were analyzed.

Study procedure:

All histologic specimen following both monopolar and bipolar TURBT were analyzed and thermal damage was graded quantitatively and qualitatively. Monopolar TURBT was performed using glycine as irrigant with monopolar loops and monopolar device. Bipolar TURBT was performed using saline as irrigant and bipolar loop device will Alan's bipolar device. Two pathologists who examined the specimen were blinded. Thermal damage was categorized into 3 groups according to quantity of cautery artifacts (2) and qualitative pathological grading (4).

Quantitative Grading:-

- Grade 1 for a given case defined as cautery artifacts involving less than one third of the entire specimen.
- Grade 2 -tissue chips with one third to two thirds cautery artifacts
- Grade 3 -tissue chips with over two thirds cautery artifacts (5)

Qualitative Degree of thermal damage Characterization (WHO Grading System)

0 - No thermal damage

1- Lowest grade of thermal artifacts- The cellular structure is identifiable and not impaired.

2- Medium grade- Cellular structure and nuclei are impaired, but still identifiable.

3 - High grade artifacts- Complete loss of the cellular structure. No differentiation of the cellular parts.

Exclusion Criteria

Inadequate specimen Excessively charred specimen on gross appearance

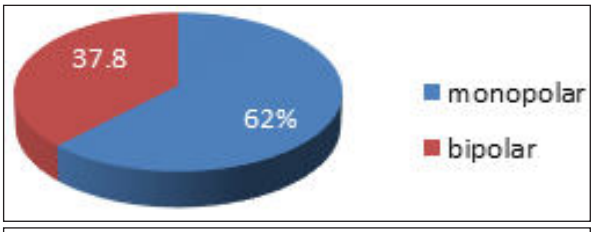
Statistical Analysis:-

1) The numerical data was tested for normality and those found to be normal distributed, paired' test used and those not normally distributed Wilcoxon sign rank test were used.
2) The categorical data was expressed in percentage and proportions and compared using chi-square test, fischer exact test and Mc nemur test.

RESULTS

Total number of subject evaluated in this study was 45. The frequency distribution of energy source used in this study is given below (fig 1). The mean age was 55.8 years with youngest being28 years and oldest being 89 years. There were 3 females in the study group and the rest were males.

We retrospectively analyzed various histopathological artifacts in tissue obtained using either monopolar or bipolarenergy.28 (62.23%) of subjects underwent transurethral resection of bladder tumor using monopolar device with 1.5 % glycine as irrigant and 17(37.7%) of subjects underwent transurethral resection of bladder tumor using bipolar device with 0.9% normal saline as irrigant



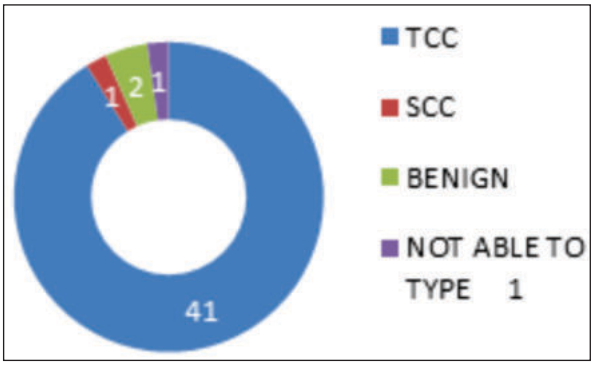


Fig-2.Distribution of histological types of bladder growth

Tab-1.distribution Quantitative Grading Of Thermal Artifact Among The Tumors Resected

Quantitative grade	Frequency	Percent
0	11	24.4
1	21	46.7
2	9	20.0
3	4	8.9
TOTAL	45	100.0

Tab-2.distribution Of Qualitative Grading Of Thermal Artifact A.mong The Tumors Resected

Qualitative grading	Qualitative grading	Percent
0	14	31.1
1	25	55.6
2	2	4.4
3	4	8.9
TOTAL	45	100.0

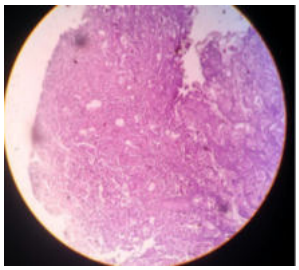


Fig no 3:- qualitative and quantitative artefact Grade 2 in tissue resected using monopolar – Low power 10x

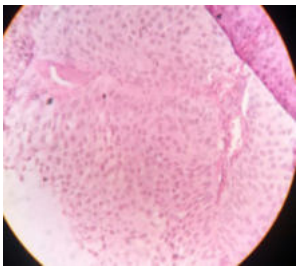


Fig no 4:- no thermal injury in tissue resected Using monopolar device – high power 40x.

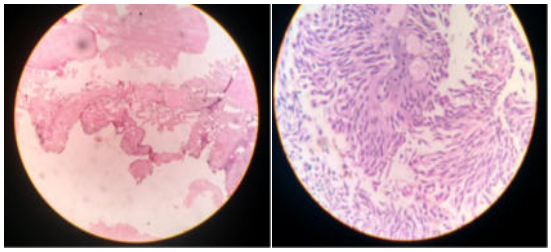


Fig no 5:- qualitative grade 3 and quantitative Grade 1 artifact in tissue resected usingMonopolar device – low power 10x.

Fig no 6:- qualitative grade 1 artifact in tissue Resected using bipolar device. High power 40x

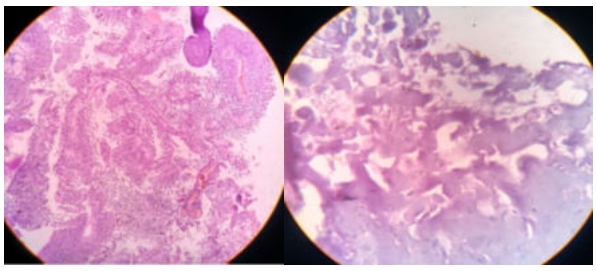


Fig no 7:- qualitative and quantitative artefact - grade 2 in tissue resected using bipolar device. Low power 10x

Fig no 8:- grade 3 both qualitative and quantitative artifact in tissue resected using Bipolar device. Low power 10x

Table No 1.21- Association Between The Energy Source Used And Quantitative Grade

Energy source used	Quantitative grade				Total
	0	1	2	3	
Monopolar	7	14	3	4	28
	25.0%	50.0%	10.7%	14.3%	100.0%
Bipolar	4	7	6	0	17
	23.5%	41.2%	35.3%	0.0%	100.0%
Total	11	21	9	4	45
	24.4%	46.7%	20.0%	8.9%	100.0%

Fisher's Exact Test -5.282
p value = .141
Not Significant

Table No 1.22 Association Between Energy Source Used Andthe Qualitative Grade

Energy used source	Qualitative grade				Total
	0	1	2	3	
Monopolar	8	15	2	3	28
	28.6%	53.6%	7.1%	10.7%	100.0%
Bipolar	6	10	0	1	17
	35.3%	58.8%	0.0%	5.9%	100.%
Total	14	25	2	4	45
	31.1%	55.6%	4.4%	8.9%	100.0%

Fisher's Exact Test 1.370
p value = .864
Not significant

Statistical Analysis:-

1) The numerical data was tested for normality and those found to be normal distributed, paired' test used and those not normally distributed Wilcoxon sign rank test were used.
2) The categorical data was expressed in percentage and proportions and compared using chi-square test, fischer exact test and Mc nemur test

DISCUSSION

Urothelial carcinoma of bladder is the most common urological malignancy. These tumours are usually non muscle

invasive at first presentation. The pathological spectrum of this disease varies form CIS, low grade papillary or sessile, high grade lesions which may be muscle invasive or non-invasive. Muscle invasion determines the pathological T stage of the disease which is essential in determining the treatment strategy to be offered and also help in further prognostication of this disease.

This pathological staging is initially determined on the histopathology of bladder tissue resected by transurethral resection of bladder tumour. It is recommended that a repeat TURBT is performed to all T1 tissue to correctly stage the disease as there is 25- 40 % chance of upgrading of the stage of the tumor. Hence, this procedure has to be done meticulously avoiding any tissue and thermal artefact.

Various studies have compared the two energy sources used to perform transurethral resection of bladder tumor but a very few studies have compared the histopathological artefact in tissue obtained using these two energy sources. Plus these studies have used either very subjective method like pathologist interpretation, used measurement in mm, only quantitative grading or qualitative grading (1,2,4,9).

Comparison of thermal artifacts between bipolar and monopolar TURBT- histopathological considerations

Deep biopsy is essential in TURBT for proper pathologic diagnosis and for deciding the line of management either conservative or more radical treatment (1–3). Recently TURBT biopsies have been done using bipolar devices. There are a very few studies comparing the thermal artifact in tissue biopsies of TURBT and further less number of studies comparing the thermal artifact between the monopolar and bipolar devices. As this is relatively newer modality the accuracy of the histological specimen in diagnosing and staging the bladder cancer has to be studied in comparison with conventional monopolar devices.

Various conflicting outcomes have been published in the literature regarding the thermal artifact in specimen obtained using monopolar versus bipolar devices. However, these studies have lacked standardization in scales used to describe thermal artifact, surgical procedure, the experience of surgeon, etc. Hence these out comes have to be taken with some degree of skepticism.

According to Venkataramani. V et al the incidence of thermal artifact was significantly lower in bipolar arm compared to monopolar arm (6). This is an RCT comparing monopolar vs bipolar devices but there were some drawback which the author has agreed like issues with blinding, lab measurement and protocol violations (6). Other studies were merely case series and observational studies that supported the theory that bipolar energy inherently will cause less thermal artifact in view of the design of the equipment (2,8).

However surprisingly there are an equally substantial number of studies that have contradicted this and have not found any significant difference in the thermal artifact when both the energy source are used (1,9). As per Wang et al, in both monopolar and bipolar devices larger degree of cautery artifact was noted in the tissue of larger tumours resected but the incidence and degree of cautery artefact was same. In fact, Maddox et found that thermal artifact is more using bipolar vaporization button electrode approximately 10 times more of reported by bipolar loops, but this was seen in prostate and not bladder (10).

Lagerveld et al in their article stated that the potential factors that determine the degree of thermal artifact are(9):-

1. Width of wire loop can confound the percentage of thermal artifact.- If both energy uses same thickness of loop then the extent of thermal injury is expected to be same. A larger loop leads to less contact time and thus potentially leads to less thermal artifact. Also large loop requires less movements and tissue handling would cause less thermal artifact.
2. Experience of surgeon- Thermal damage depends on the time of contact with heat. The velocity of resection determines the time of contact through the tissue thus determining the thermal artifact.
3. Location of the resected area: - Location of the resected area determines the feasibility of making a smooth resection and hence contact time and area. The dome and neck of the bladder or tumors in diverticula are difficult to approach. But, Wang et al did not find any difference in trends of thermal artifact based on the location of tumor.
4. Type of tissue also determines the thermal artifact: - Epithelium and submucosal lamina propria are easily damaged by heat and mechanical forces. Due to lower tissue resistance muscle tissue is easier to cut and is less affected by thermal artifact... Also it is postulated that more thermal artifact is seen in tissue with more water.
5. Type of current: - Pure cut will cause the cells to explode because of direct heating and coagulation of cells will dry out and shrink the cells. Once, all the above factors are standardized the thermal artifact caused by monopolar and bipolar devices should be compared. The thermal artifact has been studied differently in various studies.

Studies have measured the thermal artifact in mm(1,9,10) percentage of artifact(6), qualitative grades of thermal artifact(1,4) and quantitative grade of thermal artifact(2).

In the present study we have used both quantitative artifact and qualitative artifact scales in evaluating the thermal artifacts. The advantage of doing this is to standardize evaluation of thermal artifact and to objectively quantify it rather than subjective assessment by the pathologist.

An interesting point noted was that the same tissue chips had different quantitative and qualitative grades of thermal artifacts. For example Fig No :- 5 shows a slide which showed grade 3 qualitative artifact but the tissue had only grade 1 quantitative artifact obtained using monopolar device. This effect was seen even with bipolar device. One is not sure whether the qualitative artifact or quantitative artifact hinders the histological diagnosis.

Our pathologist did not have any difficulty in obtaining a diagnosis though 4 specimen had severe qualitative artifact and 4 had sever quantitative artifact except in two (4.4%) subjects using monopolar device the grade and muscle invasion could not be commented due to severe qualitative and quantitative artifacts caused by charring of tissues. The real implication of this in real clinical scenario is not known. In the present study there was no significant difference in the thermal artifact between the two groups i.e. monopolar and bipolar device statistically.

Limitations

The main limitation of the study is the small size of sample. Also this study is an observational study. A randomized controlled study design would be needed to establish that bipolar device as a routine while performing TURBT.

Another drawback of the study is that more than one surgeon performed this surgery. The possibility of variation in technique that could alter the amount of thermal artefact. However, this was not an issue in this study as the procedure was done by three experienced surgeons of more than 15 years of experience and only those chips were resected by single swipes in cutting mode were taken without application of excessive current.

Finally, though a well-defined criteria for thermal artefact both

quantitative and qualitative grading have been used in this study so as to reduce the ambiguity in reporting of thermal artefact. There is always an error due to subjective interpretation by the pathologists.

CONCLUSION

There was no significant difference in both quantitative and qualitative thermal artifact grades between the both the energy sources. Hence, both monopolar and bipolar devices can be effectively used to perform TURBT with no significant differences between the two in terms of intraoperative, postoperative parameters and thermal artifact.

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