

Remote AI Supported E-Multidisciplinary Oncology Conference in Breast Cancer as a Technology and Method to Optimize Outcomes in the Peripheries

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Abstract. Aim: Feasibility-reliability control of Telemedicine Systems (TS) integrated with Multimedia Systems (MS) and Artificial intelligence (AI) for remote e-Multidisciplinary Oncology Conference in Breast Cancer. **Material and Methods:** Forty (n1=40) patients suffering from breast surgical oncology malignant (n2=32) and non-malignant (n3=8) diseases classified to seven categories: Nipple Discharge, Dominant Breast Mass, Occult Breast Lesion, Early Breast Carcinoma, Advanced Breast Carcinoma, Recurrent Breast Carcinoma) and treated clinically with the standard diagnostic (Mammography, US, MRI, Cytology, Pathology, BRCA1/2 Mutation Predisposition and Breast Cancer Risk Analysis) surgical, auxiliary therapeutic methods. Then clinical decisions compared to those proposed remotely by the virtual AI supported e-Oncology Conference for each patient. **Results:** In four (n4=4) out of forty patients (TS, MS and AI) supported decision making and surgical treatment proposal including postoperative Radiotherapy proposal was not as clear as expected. Non-output answer for non-malignant breast pathologies (n3=8) was accurately indicated by (MS and AI). Mean accuracy of (TS, MS and AI) for: **1.**Surgical Operative Planning including Rad=94.1%, **2.**Chem=96.8%, **3.**Horm=96.7% [In 95%, (Confidence interval: 85-99%)]. **Conclusion:** High feasibility-reliability of the virtual AI supported e-Multidisciplinary Oncology Conference for remote decision making and surgical planning and for optimum outcomes in Breast Cancer treatment makes it a clinical necessity especially for the periphery of Hellas.

Keywords. Breast Surgery, Tele-Radiology, Tele-Pathology, Tele-Cytology, AI, E-Multidisciplinary Oncology Conference

1. Introduction

The optimal management of patients with breast cancer (BC) requires the expertise of specialists from different disciplines. This has led to the evolution of multidisciplinary teams (MDTs), allowing all key professionals to jointly discuss individual patients and

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to contribute independently to clinical decisions. Also, it proved that MDTs for Multidisciplinary Oncology Conference in cooperation with Multidisciplinary Management of the breast cancer in high volume Breast Units optimize quality and have significantly better clinical outcomes for the benefit of the patients. However, MDTs for BC decision making in different regions in the periphery of Greece and in other countries are scarce [1,2]. The project searches feasibility-reliability of Telemedicine Systems (TS) integrated with Multimedia Systems (MS) and Artificial intelligence (AI) for remote e-Multidisciplinary Oncology Conference in Breast Cancer interrelated with Telepathology (TPE), Teleradiology (TRE) and Telecytology (TCE) remote evaluation [3,4,5].

2. Material and Methods

Experimentation included the development of an OTE-TS similar Experimental TS (Exp.-TS) for the simulation of the integrated TS, MS and AI based TRE and TPE and TCE virtual examination of each patient (pn 1009078, 34931, 34932, 34933) (Table 1.).

Table 1. Comparison of the Modules between OTE-TS and Exp.-TS

Modules	OTE-TS	EXP.-TS
a. Medical record process	+	+
b. Examinations results.	+	+
c. Capture scanning and imaging.	+	+
d. DICOM and PACS vision.	+	+
e.Real-time tele-conference	+	+
f. Chat and whiteboard facilities.	+	+
g. Application sharing.	+	+
h. Tele-secretary facilities.	+	+
j. Tele-Mentoring facilities	+	+
i. Telecommunication net	ISDN based	Internet based
k. Multimedia System	+	+
l.AI computation system	-	+

Simulation of the TRE upon N=40 Mammographic, MRI, CT, Breast and Upper Abdomen US digital images projected on the Exp.-TS in the internet (Cloud) for remote examination and decision making upon the virtual e-Multidisciplinary Breast Oncology Conference (Figure 1.). Simulation of the TPE including TCE based on the already worked out breast biopsies and their results for N=40 digital microscopic images.

Integrated AI supported Decision Making (including clinical interventions and genetic consultation) and Surgical Planning analysis using SPSS (version 17.0).

Forty (n1=40) patients suffering from breast surgical oncology malignant (n2=32) and non-malignant (n3=8) diseases classified to seven categories: Nipple Discharge, Dominant Breast Mass, Occult Breast Lesion, Early Breast Carcinoma, Advanced Breast Carcinoma, Recurrent Breast Carcinoma) and treated clinically with the standard diagnostic (Mammography, US, MRI, Cytology, Pathology, BRCA1/2 Mutation Predisposition and Breast Cancer Risk Analysis) surgical, auxiliary therapeutic methods. Then the diagnostic and therapeutic clinical decisions compared to those proposed by our (MS and AI) supported decision making and planning system and logic process for each patient.

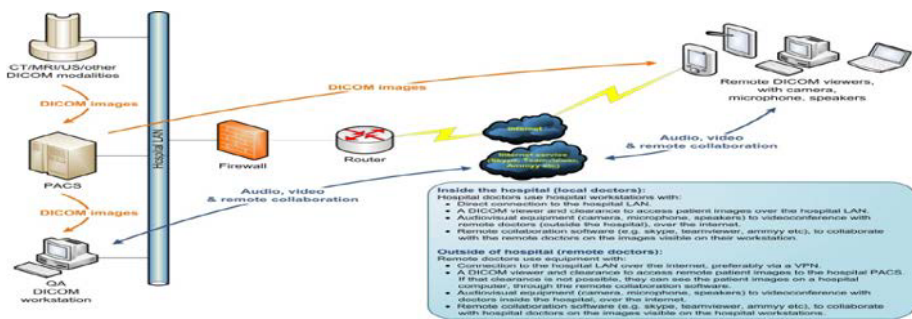


Figure 1. Simulation of the remote collaboration among specialists in the context of the remote virtual e-Multidisciplinary Breast Oncology Conference *via* internet (PACS and DICOM based remote examination).

3. Results

In four (n4=4) out of forty (n1=40) patients (TS, MS and AI) supported decision making and surgical treatment proposal including postoperative Radiotherapy proposal was not as clear as expected. Non-output answer for non-malignant breast pathologies (n3=8) was accurately indicated by (TS, MS and AI). Mean accuracy of (TS, MS and AI) for: **1.Surgical Operative Planning** including Rad=94.1%, **2.Chem**=96.8%, **3.Horm**=96.7% [In 95%, (Confidence interval: 85-99%)] (Tables 2, 3, 4).

Table 2. Simulated TRE (Mammography, MRI, CT, Breast and Upper Abdomen US)

	N	TP	FP	FN	TN	SENSITIVITY	SPECIFICITY	ACCURACY
Patients and Lesions	40	32	0	0	8	100,0	100,0	100,0

N=Number of digital images given for examination, TP=True Positive, FP=False Positive, FN=False Negative, TN=True Negative, Sensitivity(%), Specificity(%), Diagnostic accuracy (Efficiency) (%))

Table 3. Simulated TPE including TCE

	N	TP	FP	FN	TN	SENSITIVITY	SPECIFICITY	ACCURACY
Patients and Lesions	40	32	0	0	8	100,0	100,0	100,0

N=Number of digital images given for examination, A=Number of Answers after Examination, TP=True Positive, FP=False Positive, FN=False Negative, TN=True Negative, Sensitivity(%), Specificity(%), Diagnostic accuracy (Efficiency) (%))

Table 4. AI supported Decision Making and Surgical Planning

	N	TP	TN	ACCURACY+Rad	ACCURACY+Chem	ACCURACY+Horm
Surgical Planning	40	36	8	94.1%	96.8%	96.7%

N=Number of images given for examination, TP=True Positive, FP=False Positive, FN=False Negative, TN=True Negative, AI Supported Decision making and planning Accuracy (Efficiency)(%).

4. Discussion

Given the lack of Multidisciplinary Oncologic Conferences in the periphery of Greece and the fact that the clinical outcomes of the patients suffering from breast cancer are better under multidisciplinary management in high volume breast units the abovementioned results are very promising to realize virtual e-Multidisciplinary

Oncology Conference to optimize quality of breast cancer management in the beginning. The results confirmed clinically in the periphery of Greece with a case of a female patient suffering from an exacerbation of right breast cancer (Extended loco-regional right breast angio-sarcoma) which treated initially with chemotherapy (May 2021). Then treated with an additional chemotherapy schedule based on the decision of the remote e-Multidisciplinary Oncology Conference in Breast Cancer using the above described technology and method (TS, MS and AI from the General Hospital of Kalymnos, June 2021). With regard to safety issues Morgan [6] proposed the Virtual private networks (VPN) as adequate solutions for authentication, access control and confidentiality. The secure hypertext transfer protocol (https) can be used to encrypt for web distribution. A public key infrastructure (PKI) solves all the issues mentioned above. Clinical efficacy research protocols for further study of the remote e-Multidisciplinary Oncology Conference in Breast Cancer is of high priority [7,8].

5. Conclusion

High feasibility-reliability of the virtual e-Multidisciplinary Oncology Conference in Breast Cancer integrated with AI supported decision making and treatment in Breast Cancer, makes it a clinical necessity for optimum clinical management and treatment of the breast cancer especially for the periphery of Hellas.

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