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CAN RURAL TELEMEDICINE GENERATE DATABASES WITH IMPACT IN RESEARCH AND EDUCATION?

CARMEN DANIELA NICOLAU[1], IOANA-NATALIA BERNATCHI[2], MADALINA IOANA PETRUT[3], GABRIELLA GABOS[4], SEPTIMIU VOIDAZAN[5]

[1,2,3,4]Lotus Image Medical Center, Actamedica, Targu Mures, [5]University of Medicine, Pharmacy, Sciences and Technology, George Emil Palade, Targu Mures

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Abstract: *Screening of weight related diseases can be done in rural areas with the help of telemedicine. The purpose of our study is to statistically analyze correlation between overweight and chronic liver diseases inside of the data obtained by teleconsultations including abdominal tele-ultrasound (TeleUS). Material and method: teleconsultations with teleUS were performed in five offices of family doctors in Mures county. They consisted of remote consultation and ultrasound examinations of patients by gastroenterologists from Lotus Image Medical Center from Targu Mures in collaboration with family doctors. The data recorded in the medical letters, were entered in the databases and analyzed statistically. Results: hepatomegaly occurs more frequently in people with obesity grade II and III, hepatic steatosis is associated with obesity and cholelithiasis correlates with the female sex and age but not with obesity. Conclusion: performing synchronous teleconsults and teleUS generates information about the health of the rural population with potential impact in research, education and prevention.*

INTRODUCTION

Moving the consultation to the virtual space, associated with synchronous tele-ultrasound examinations compensates the limitations and brings new diagnostic elements that increase the value of the medical act.(1,2)

In this study we present the experience accumulated on 477 gastroenterological teleconsultations that included, mandatory, tele-ultrasound in synchronous mode. At the end of each examination, a medical letter was drafted, which included the ultrasound parameters. All standard information from medical letter were introduced in a database and were analyzed statistically.(3)

AIM

Evaluation of the statistical data of the database resulting from teleconsultations with synchronous teleUS performed in rural areas. Based on the results obtained, preventive medicine strategies can be developed and resources in the health field can be better managed.

MATERIALS AND METHODS

The remote ultrasound examinations were performed by family doctors from rural localities in direct communication with gastroenterologist specialists with competence in ultrasound, from Targu Mures university center, Romania.

The equipment used was Telemed LS64 FLT-1T with EchoWave II (EWII) tele-ultrasound software. (4)

Ultrasound images were simultaneously examined on the GP and specialist laptops and the ultrasound expert could set the parameters of the ultrasound device remotely and verbally guide the examiner to obtain the optimal examination sections. (5) The three members of the team contributed to the elaboration of the medical letter: the patient declared the symptoms, the personal and heredo-colateral history and the treatment, the examiner-family doctor helped with the patient history and treatments, provides details of the direct clinical examination, the gastroenterologist and ultrasound specialist drafted the result of the ultrasound examination, established the diagnosis and treatment assuming the responsibility of the medical letter. (6) The result came at the same time in the possession of the three, in digital format or on paper. The examinations could be stored both in the form of images and video recordings. From the standardized accumulated data, a database was established in excel format on which the statistical analysis was applied. All patients have signed the informed consent before the examination.

RESULTS

The statistical analysis was performed using the statistical software MedCalc, version 12.5.0.0., respectively GraphPad Prisma. The data were considered as nominal or quantitative variables. Nominal variables were characterized by frequencies. Quantitative variables were tested by a distribution normality, using the Kolmogorov - Smirnov test, and were characterized by median, mean and standard deviation (SD). (7) The chi-squared test was used to compare the frequencies of nominal variables.(8) Quantitative variables were compared using the t-test. The correlation between quantitative variables was evaluated using the Pearson correlation.(9) The level of statistical significance was established at $p < 0,05$.

The average age of the investigated persons was 55.4 years, with a median of 58 years. For women, the average age

[1]Corresponding author: Carmen Daniela Nicolau, Pasajul Padurii 42, Târgu Mureş, Mureş, E-mail: carmen.nicolau@gmail.com, Phone: +40732741994

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was 54.4 years, the average of 57 years. For men, the average age was 57.1 years, the average was 59.5 years.

BMI in groups standardized according to WHO, as follows:

Table no.1. BMI groups standardized

Under weight	Normal weight	Over weight	Obesity grade I	Obesity grade II	Morbid Obesity
18.49 or less	18.50 and 24.99	25.00 and 29.99	30,00 and 34,99	35,00 and 39,99	40.00 or more

The weighting status was assessed by means of the values of the index de corporeal mass - BMI.

Normoponderality was identified in 28.9% of the people of our group, but an increased proportion of overweight people was observed (34.4%), and the cumulative percentages of people with varying degrees of obesity exceed 30%. In the table below we have followed the correlation between age and body weight.

Table no.2. The relationship between BMI and age

p-0,02			age groups								Total
			<20	21-30	31-40	41-50	51-60	61-70	71-80	over 80	
BMI	underweight	number	2	3	3	3	4	2	1	0	18
		%	11,1%	16,7%	16,7%	16,7%	22,2%	11,1%	5,6%	0,0%	100,0%
	normoponderal	number	3	16	24	17	19	29	22	8	138
		%	2,2%	11,6%	17,4%	12,3%	13,8%	21,0%	15,9%	5,8%	100,0%
	Overweight	number	8	7	16	21	33	37	32	10	164
		%	4,9%	4,3%	9,8%	12,8%	20,1%	22,6%	19,5%	6,1%	100,0%
	obesity grade I	number	2	3	16	9	35	31	15	4	115
		%	1,7%	2,6%	13,9%	7,8%	30,4%	27,0%	13,0%	3,5%	100,0%
	obesity grade II	number	0	3	5	5	7	6	4	0	30
		%	0,0%	10,0%	16,7%	16,7%	23,3%	20,0%	13,3%	0,0%	100,0%
	obesity grade III	number	0	0	1	0	2	6	1	2	12
		%	0,0%	0,0%	8,3%	0,0%	16,7%	50,0%	8,3%	16,7%	100,0%
	Total	number	15	32	65	55	100	111	75	24	477
		%	3,1%	6,7%	13,6%	11,5%	21,0%	23,3%	15,7%	5,0%	100,0%

Women dominating the percentage in subgroup of normoponderal people, but also when in overweight or obesity (table no. 3). The difference between sexes there is not significant (p-0.89)

Table no.3. Relationship between the sexes and BMI

p-0.89			Sex		Total
			F	M	
BMI	underweight	number	13	5	18
		%	72,2	27,8	100
	normoponderal	number	84	54	138
		%	60,9	39,1	100,
	Overweight	number	98	66	164
		%	59,8	40,2	100
	obesity grade I	number	73	42	115
		%	63,5	36,5	100
	obesity grade II	number	20	10	30
		%	66,7	33,3	100
	obesity grade III	number	7	5	12
		%	58,3	41,7	100
Total		number	295	182	477
		%	61,8	38,2	100

Hepatomegaly was noted in about one-fifth of the people investigated; the table below on the relationship between the standard classes of BMI and the size of the liver does not reveal a significant relationship (square chi test: p-0,16).

However, one third of obese people in grade II and 5 out of 7 with obesity grade III have hepatomegaly.

Table no.4. The relationship between BMI and hepatomegaly

P-0.16	Liver Dimensions		
BMI groups	Normal values	Elevated values	%
Underweight	17	1	18 (3,8%)
Normoponderal	110	28	138 (28,9%)
Overweight	127	37	164 (34,4%)
Obesity grade I	88	27	115 (24,1%)
Obesity grade II	20	10	30 (6,3%)
Obesity grade III	7	5	12 (2,5%)
Total	369 (77,4%)	108 (22,6%)	477

The differences between normal or elevated liver values, depending on BMI, is evident when we used quantitative values, thus noting that people with hepatomegaly have on average BMI values of 28.83 kg/m^2, statistically higher (p-0.009) compared to people without hepatomegaly, where the average BMI was 27.22 kg/m^2 (figure no. 1).

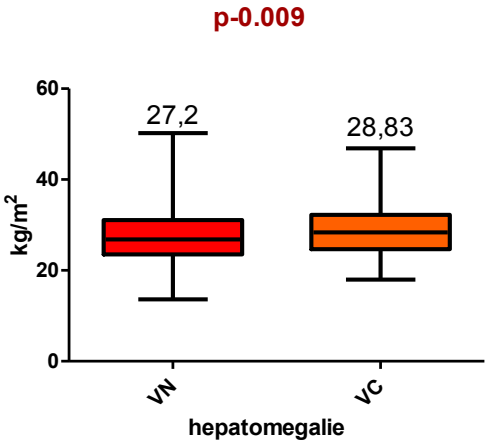

Figure no.1. The significant difference between people with and without hepatomegaly, in relation to BMI

Hepatic steatosis was revealed in about 40% of the monitored people, many of them having obesity grade I. (table no.5, figure no.2)

Table no.5. Relationship between BMI and

p-0.15	Steatosis		
	not	yes	
BMI groups			
Underweight	14	4	18 (3,8%)
Normoponderal	86	52	138 (28,9%)
Overweight	100	64	164 (34,4%)
Obesity grade I	57	58	115 (24,1%)
Obesity grade II	19	11	30 (6,3%)
Obesity grade III	7	5	12 (2,5%)
Total	283 (59,3%)	194 (40,7%)	477

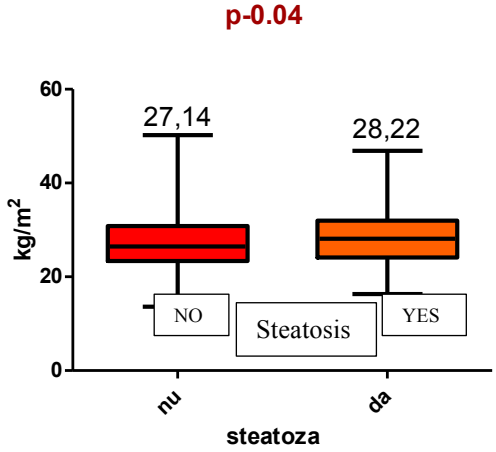

Figure no.2. The significant difference between people with and without steatosis, in relation to BMI

As in the case of hepatomegaly, BMI values in people with steatosis were significantly higher (p-0.04) compared to people without steatosis.(10)

Cholelithiasis is a condition more common in the female sex (75.9% of cases with lithiasis) compared to the male sex (only 24.1%), (table no.7).(11)

Another statistical approach demonstrates that the average age of patients with cholelithiasis is higher and statistically significant (p-0.01) than the average age of patients without lithiasis (table no.6, figure no.3)

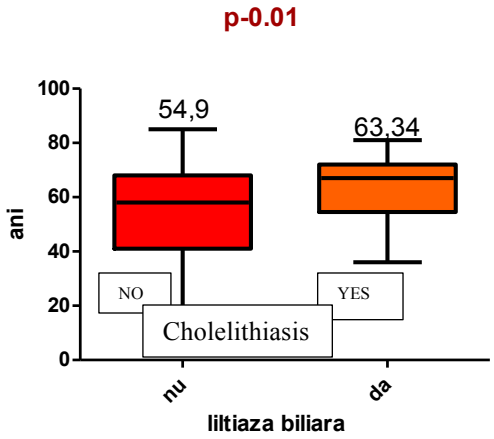

Figure no.3. The significant difference between people with and without cholelithiasis, in relation to age

Table no.6. Relationship between age groups and cholelithiasis

p-0.11			Biliary lithiasis		Total
			not	yes	
age groups	<20	number	15	0	15
		%	100,0%	0,0%	100,0%
	21-30	number	32	0	32
		%	100,0%	0,0%	100,0%
	31-40	number	64	1	65
		%	98,5%	1,5%	100,0%
	41-50	number	53	2	55
		%	96,4%	3,6%	100,0%
	51-60	number	90	10	100
		%	90,0%	10,0%	100,0%
	61-70	number	104	7	111
		%	93,7%	6,3%	100,0%
	71-80	number	67	8	75
		%	89,3%	10,7%	100,0%
	over 80	number	23	1	24
		%	95,8%	4,2%	100,0%
Total		number	448	29	477
		%	93,9%	6,1%	100,0%

Table no.7. The relationship between the cholelithiasis and sexes

P-0,12			Sex		Total
			F	M	
Biliary lithiasis	no	number	273	175	448
		%	60,9%	39,1%	100,0%
	yes	number	22	7	29
		%	75,9%	24,1%	100,0%
Total		number	295	182	477
		%	61,8%	38,2%	100,0%

A centralized combination of the three variables, namely, cholelithiasis, sex and age are shown in the table below.

Of the 22 females and the 7 male persons who had cholelithiasis, most of them were aged in the 5-7 decades of life. (table no.8)

Cholelithiasis has also occurred in normoponderal and overweight people, and it is not a rule to occur only in obese people, where cholesterol values are probably high. Moreover, in people with grade I or II obesity, cholelithiasis has been identified very rarely (table no.9)

Table no.8. The relationship between the cholelithiasis, sexes and age.

Sex				age groups								Total
				<20	21-30	31-40	41-50	51-60	61-70	71-80	over 80	
F	Biliary lithiasis	not	number	10	22	45	31	52	62	37	14	273
			%	3,7%	8,1%	16,5%	11,4%	19,0%	22,7%	13,6%	5,1%	100,0%
		yes	number	0	0	1	2	7	5	6	1	22
			%	0,0%	0,0%	4,5%	9,1%	31,8%	22,7%	27,3%	4,5%	100,0%
	Total		number	10	22	46	33	59	67	43	15	295
			%	3,4%	7,5%	15,6%	11,2%	20,0%	22,7%	14,6%	5,1%	100,0%
M	Biliary lithiasis	not	number	5	10	19	22	38	42	30	9	175
			%	2,9%	5,7%	10,9%	12,6%	21,7%	24,0%	17,1%	5,1%	100,0%
		yes	number	0	0	0	0	3	2	2	0	7
			%	0,0%	0,0%	0,0%	0,0%	42,9%	28,6%	28,6%	0,0%	100,0%
	Total		number	5	10	19	22	41	44	32	9	182
			%	2,7%	5,5%	10,4%	12,1%	22,5%	24,2%	17,6%	4,9%	100,0%
Total	Biliary lithiasis	not	number	15	32	64	53	90	104	67	23	448
			%	3,3%	7,1%	14,3%	11,8%	20,1%	23,2%	15,0%	5,1%	100,0%
		yes	number	0	0	1	2	10	7	8	1	29
			%	0,0%	0,0%	3,4%	6,9%	34,5%	24,1%	27,6%	3,4%	100,0%
	Total		number	15	32	65	55	100	111	75	24	477
			%	3,1%	6,7%	13,6%	11,5%	21,0%	23,3%	15,7%	5,0%	100,0%

Table no.9. Relationship between BMI groups and cholelithia

p-0.94			Biliary lithiasis		Total
			not	yes	
BMI	under weight	number	17	1	18
		%	94,4 %	5,6%	100,0 %
	normo ponderal	number	131	7	138
		%	94,9 %	5,1%	100,0 %
	Over weight	number	153	11	164
		%	93,3 %	6,7%	100,0 %
	obesity grade I	number	107	8	115
		%	93,0 %	7,0%	100,0 %
	obesity grade II	number	28	2	30
		%	93,3 %	6,7%	100,0 %
	obesity grade III	number	12	0	12
		%	100,0 %	0,0%	100,0 %
Total		number	448	29	477
		%	93,9 %	6,1%	100,0 %

DISCUSSIONS

The teleconsultations carried out according to carefully elaborated protocols, meet the needs of the population for quality health services without being forced to travel to medical centers.(12, 13)

Remote medical consultation has many advantages: it takes the technology next to the patient and, through the device and its software, it brings the doctor and the patient at the same time in the same place - in the virtual space. (14) Decreased pollution of urban centers, fluidization of circulation, decrease the risk of transmission of pathogens and reduce the stress are secondary advantages. The disadvantages of telemedicine consist in a higher risk of omitting certain details from the direct clinical examination, prolongation of the examination time , increasing the costs per consultation because of: 1.the involvement of two medical staff with higher education, 2. the use of the expensive equipment with the double role of ultrasound examination and remote transmission, 3. the need for the internet with guaranteed bandwidth with significantly higher costs. (15)

CONCLUSIONS

Restoring the balance between the need for medical services and the availability of human resources in medicine is a

stringent desideratum. One of the mechanisms by which this desideratum can be achieved is the judicious use of the working time of the medical staff with an advanced degree of experience. Their travel to rural areas does not allow a good management of their time but the connection via the Internet cancels this deficit. To cancel the difficulty of performing the clinical examination of the patients, the collaboration between the family doctor and the specialist is required. By adding the remote ultrasound examination with the help of developing technologies, the medical act lives up to the requirements of the doctor-patient team, as shown by numerous studies in musculoskeletal, psychiatric and cardiac.(16,17,18)

The quality medical act at a distance, by paying attention to details, ensures and allows the establishment of valuable databases that can be interrogated with the purpose of developing preventive medicine strategies but also for educational purposes, research and health policies.

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