HYPOTHESIS TESTING

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OUTLINE

- Parametric methods- Tests on means: Are two means the same?
  - Independent or dependent samples
  - Equal or unequal variances
  - One- or two-tailed test
- Non-parametric methods:
  - Rank's tests by examples
  - Tests on proportions

INDEPENDENT SAMPLES: ARE TWO MEANS THE SAME?

Total sample size	Subgroup sample size	Equal Variances	Unequal Variances
Large size (n>50 or n>100) or σ's known	~ equal very different	Z-test	Rank-sum test
Small size	~ equal very different	t-test	Rank-sum test

Assumptions: ❶ the observations are independent from each other; ❷ the samples are drawn from a normal distribution (use a Rank-test when this assumption is violated); ❸ the standard deviation of samples are not statistically different by each other (apply an unequal variance form of the means test or a rank test).

INDEPENDENT SAMPLES T-TEST

Are the variances statistically different?

t-test assuming unequal variances

t-test assuming equal variances

Z and t Tests to Compare a Sample Mean with a Population Mean

Z test

When? Population standard deviation is known OR n > 50 (100)

Hypotheses:

- $m = \mu\ (H_0)$ vs. $m \neq \mu\ (H_1)$

Significance level ($\alpha = 0.05$) → critical value with n-1 df (degree of freedom)

Test statistics:

$z = (m-\mu)/(\sigma/\sqrt{n})$ where σ = standard deviation, n = sample size

t-test

When? Unknown standard deviation OR n < 50 (100)

Hypotheses:

- $\mu_1 = \mu_2\ (H_0)$ vs. $\mu_1 \neq \mu_2\ (H_1)$

Significance level ($\alpha = 0.05$) → critical value with n-1 df (degree of freedom)

Test statistics:

$t = (m-\mu)/(s/\sqrt{n})$ where s = standard deviation, n = sample size

Z and t Tests to Compare a Sample Mean with a Population Mean – Problem 1

Z-test

- $\mu = 0$ (H_0) vs $\mu \neq 0$ (H_1)
- $\alpha = 0.05$
- $\sigma = 1.75$
- $n = 15$
- $m = 3.87$
- $Z_{crit} = 1.96$

$Z = ?$

Conclusion ?

T-test

- $\mu = 0$ (H_0) vs $\mu \neq 0$ (H_1)
- $\alpha = 0.05$
- $s = 2.50$
- $n = 15$
- $m = 3.87$
- $t_{crit} = 2.145$

$Z = ?$

Conclusion ?

z and t tests to Compare Two Sample Means

- Age and prostate cancer t-test
  - negative biopsy: $n_1 = 206$; $m_1 = 66.59$ years; $s_1 = 8.21$ years
  - positive biopsy: $n_2 = 95$; $m_2 = 67.14$ years; $s_2 = 7.88$ years
  - $\sigma = 8.10$ (n=301)
  - $\alpha = 0.05 \rightarrow t_{critical} = 1.96$
  - $s_d = \text{sqrt}((1/206+1/95)\cdot(205*8.21^2+94*7.88^2)/(206+95-2)) = 1.01$
  - $t = (m_1-m_2)/s_d \rightarrow t = (66.59-67.14)/1.01 = -0.54$ (p=0.582)
  - $-1.96 \leq -0.54 \leq +1.96 \rightarrow$ we failed to reject the null hypothesis (Age is not a risk factor for prostate cancer)

For samples > 100 the difference between z and t statistics is negligible while the p-value is identical

THREE OR MORE MEANS: ANOVA

Are the means of k groups different?

- H_0: There are no differences among the m_i.
- H_1: A difference exists somewhere among the groups
- Is the t-test appropriate? No, because the t-test compare two groups and this approach will increase the size of the error – 9.75%)
- Solution: apply ANOVA (analysis of variance, one-factor ANOVA or one-way ANOVA)
- Assumptions: ❶ data are independent from each other; ❷ distribution of each group in original data is normal; ❸ the variances are not significantly different by each other

THREE OR MORE MEANS: ANOVA

- Hypotheses: H_0: There are no differences among means vs. H_1: There are one or more differences somewhere among means
- Verify assumptions: ❷ normal distribution; ❸ not statistically different variances
- $\alpha = 0.05$ – df = k-1 (numerator) and df = n-k (denominator)
- F = MSM/MSE
- If $F > F_{crit} \rightarrow$ reject H_0; $F < F_{crit} \rightarrow$ failed to reject H_0

Source of variability	Sum of Squares			Mean of squares	
	Abb	Formula	df	Abb	Formula
Mean	SSM	$\sum^{k} n_i \cdot (m_i - m)^2$	k-1	MSM	SSM/(k-1)
Error	SSE	SST – SSM	n-k	MSE	SSE/(n-k)
Total	SST	$\sum^{n} (x_i - m)^2$	n-1	MST	SST/(n-1)

THREE OR MORE MEANS: ANOVA - PROBLEM 2

α=0.05; df: k-1=3-1=2; n-k=301-3=298; F_{crit} = 3.03; m = 66.8; SST = 19670.3; MST = 65.57

PSA	CaP risk group	n	m	s
< 4 ng/ml	Low	89	66.1	9.1
4–10 ng/ml	Uncertain	164	66.3	7.8
>10 ng/ml	High	48	69.6	6.4

PSA=prostate-specific antigen; CaP = prostate cancer; n = sample size; m = mean; s = standard deviation

Source of variability	Sum of Squares			Mean of squares	
	Abb	Formula	df	Abb	Formula
Mean	SSM	$\sum^{k} n_i \cdot (m_i - m)^2$	k-1	MSM	SSM/(k-1)
Error	SSE	SST – SSM	n-k	MSE	SSE/(n-k)
Total	SST	$\sum^{n} (x_i - m)^2$	n-1	MST	SST/(n-1)

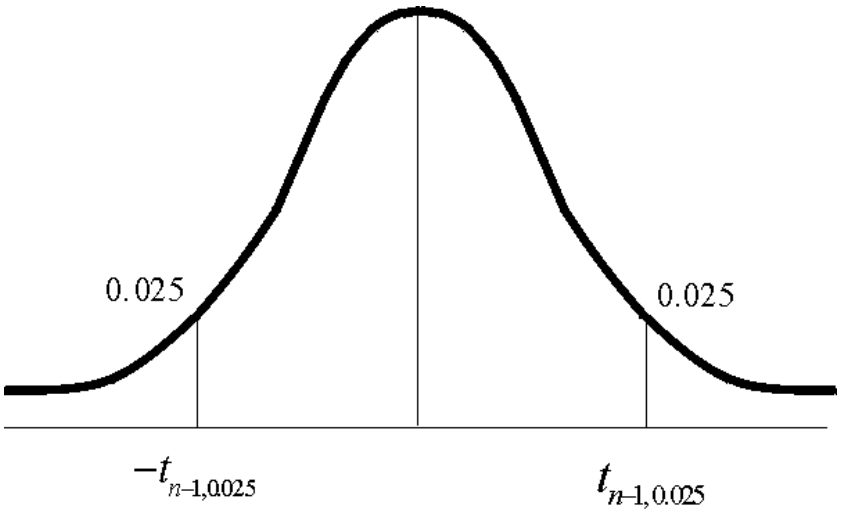
PAIRED SAMPLES
STUDENT T-TEST FOR COMPARING MEANS

- **Aim:** comparing the means of two paired samples on quantitative continuous variable (paired means the observation of the same quantitative variable before and after the action of a factor)
- **Assumptions:**
  - Individual observations from the first sample corresponds to a pair in the second sample
  - The differences between pairs of values are normally distributed.
- **Null hypothesis**: The mean of difference of paired data is not significantly different by zero.
- **Alternative hypothesis** for two-tailed test: The mean of difference of paired data is significantly different by zero.

STUDENT (T) FOR COMPARING MEANS OF PAIRED SAMPLES

- **Degrees of freedom (df):** $df = n - 1$
- **Significance level**: $\alpha = 0.05$
- **Critical region:**

$$(-\infty;-t_{n-1;\frac{\alpha}{2}}]\cup[t_{n-1;\frac{\alpha}{2}};+\infty)$$



- **Statistics**

$$t = \frac{\bar{d}}{\frac{s}{\sqrt{n}}}$$

$$\bar{d} = \frac{(d_1 + d_2 + \ldots + d_n)}{n}$$

- s = standard deviation of the differences
- n = sample size

PAIRED STUDENT T-TEST

Paired *t* Test

Denote the test statistic $\bar{d}/(s_d/\sqrt{n})$ by t, where s_d is the sample standard deviation of the observed differences:

$$s_d = \sqrt{\left[\sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2 \Big/ n\right] \Big/ (n-1)}$$

n = number of matched pairs

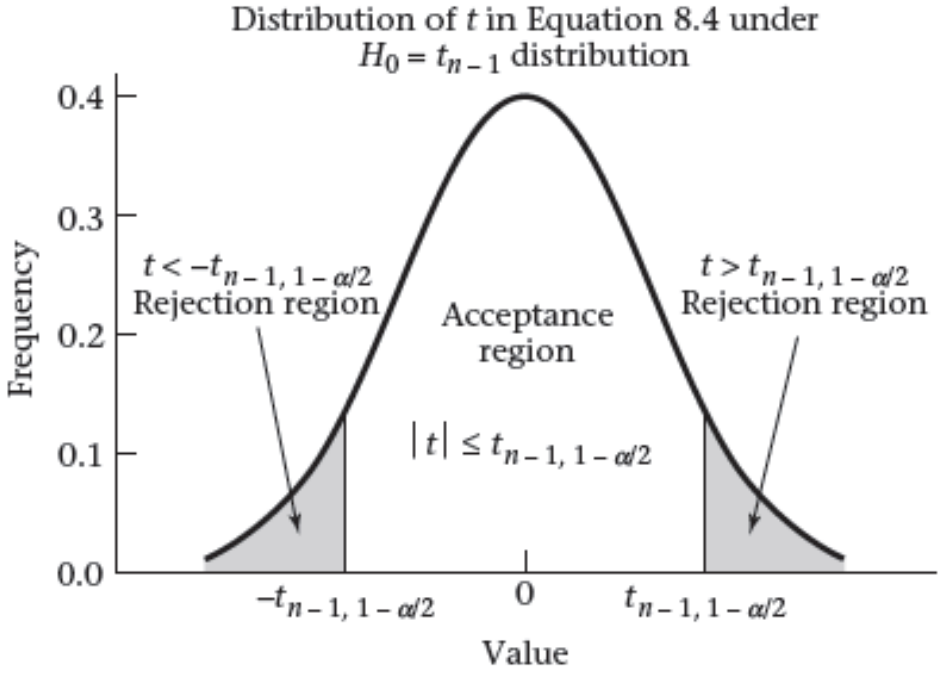
If $t > t_{n-1,1-\alpha/2}$ or $t < -t_{n-1,1-\alpha/2}$

then H_0 is rejected.

If $-t_{n-1,1-\alpha/2} \le t \le t_{n-1,1-\alpha/2}$

then H_0 is accepted. The acceptance and
in Figure 8.1.

Figure 8.1 Acceptance and rejection regions for the paired *t* test



PAIRED STUDENT T-TEST

SBP levels (mm Hg) in 10 women while not using (baseline) and while using (follow-up) OCs

i	SBP level while not using OCs (x_{i1})	SBP level while using OCs (x_{i2})	d_i^*
1	115	128	13
2	112	115	3
3	107	106	−1
4	119	128	9
5	115	122	7
6	138	145	7
7	126	132	6
8	105	109	4
9	104	102	−2
10	115	117	2

*$d_i = x_{i2} - x_{i1}$

Assume that the SBP of the ith woman is normally distributed at baseline with mean μ_i and variance σ^2 and at follow-up with mean $\mu_i + \Delta$ and variance σ^2.

STUDENT T-TEST FOR COMPARING MEANS OF PAIRED SAMPLES

- **Null hypothesis**: There is no significant difference in systolic blood pressure before and after having used of oral contraceptives.
- **Alternative hypothesis** for two-tailed test: There is a significant difference in systolic blood pressure before and after having used of oral contraceptives.
- **Degrees of freedom**: df = n – 1 = 10-1 = 9
- **Significance level**: $\alpha = 0.05$
- **Critical regions** for two-tailed test: $(-\infty;\ -2.262] \cup [2.262;\ +\infty)$

STUDENT T-TEST FOR COMPARING MEANS OF PAIRED SAMPLES

$$\bar{d} = \frac{13+3-1+9+7+7+6+4-2+2}{10} = \frac{48}{10} = 4.8$$

$$s = \sqrt{\frac{67.24+3.24+33.64+(4.2)^2+2\cdot 4.84+1.44+0.64+46.24+7.84}{10-1}} = \sqrt{\frac{187.60}{9}} = \sqrt{20.84} = 4.57$$

$$t = \frac{\bar{d}}{\frac{s}{\sqrt{n}}} = \frac{4.8}{\frac{4.57}{\sqrt{9}}} = \frac{4.8}{\frac{4.57}{3}} = \frac{4.8}{1.52} = 3.15$$

Conclusion (two-sided test):

- Statistical: The null hypothesis is rejected since the statistics belongs to critical region.
- Clinical: The use of oral contraceptives is associated to a significant increase in systolic blood pressure.

PROBLEM 3

1 How do a paired-sample design and an independent-sample design differ?

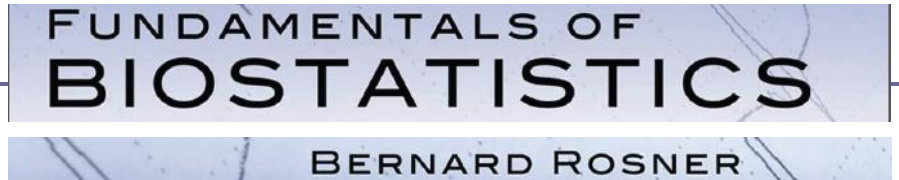
2 A man measures his heart rate before using a treadmill and then after walking on a treadmill for 10 minutes on 7 separate days. His mean heart rate at baseline and 10 minutes after treadmill walking is 85 and 93 beats per minute (bpm), respectively. The mean change from baseline to 10 minutes is 8 bpm with a standard deviation of 6 bpm.

(a) What test can we use to compare pre- and post-treadmill heart rate?

(b) Implement the test in Review Question 8A.2a, and report a two-tailed *p*-value.

(c) Provide a 90% confidence interval (CI) for the mean change in heart rate after using the treadmill for 10 minutes.

(d) What is your overall conclusion concerning the data?



NONPARAMETRIC TESTS

Advantages

- Used with all scales
- Easier to compute
  - Developed originally before wide computer use
- Make fewer assumptions
- Need not involve population parameters
- Results may be as exact as parametric procedures

Disadvantages

- May waste information
  - If data permit using parametric procedures
  - Example: converting data from ratio to ordinal scale
- Difficult to compute by hand for large samples
- Tables not widely available

NONPARAMETRIC TESTS BY EXAMPLES

Variable scale	One-sample	Two-samples		K-samples	
		Related samples	Independ samples	Related samples	Independ samples
Nominal	Binomial	McNewman	Fisher exact Chi-Square	Cochran Q (dichotom)	Chi-Square
Ordinal	Kolmogorov - Smirnow	Sign Wilcoxon	Mann-Whitney	Friedman Kendall's	Kruskal-Wallis one-way analysis of variance

RANKS TEST BY EXAMPLES

Wilcoxon Signed-Rank Test (Normal Approximation Method for Two-Sided Level α Test)

(1) Rank the differences as shown in Equation 9.4.

(2) Compute the rank sum R_1 of the positive differences.

(3) (a) If $R_1 \neq \frac{n(n+1)}{4}$ and there *are no ties* (no groups of differences with the same absolute value), then

$$T = \left[\left|R_1 - \frac{n(n+1)}{4}\right| - \frac{1}{2}\right] \Big/ \sqrt{n(n+1)(2n+1)/24}$$

(b) If $R_1 \neq \frac{n(n+1)}{4}$ and there *are ties*, where t_i refers to the number of differences with the same absolute value in the ith tied group and g is the number of tied groups, then

$$T = \left[\left|R_1 - \frac{n(n+1)}{4}\right| - \frac{1}{2}\right] \Big/ \sqrt{n(n+1)(2n+1)\Big/24 - \sum_{i=1}^{g}(t_i^3 - t_i)/48}$$

(c) If $R_1 = \frac{n(n+1)}{4}$, then $T = 0$.

(4) If

$$T > z_{1-\alpha/2}$$

then reject H_0. Otherwise, accept H_0.

(5) The p-value for the test is given by

$$p = 2 \times [1 - \Phi(T)]$$

(6) This test should be used only if the number of nonzero differences is ≥ 16 and if the difference scores have an underlying continuous symmetric distribution. The computation of the p-value is illustrated in Figure 9.5.

FUNDAMENTALS OF BIOSTATISTICS
BERNARD ROSNER

TESTS ON PROPORTIONS

Two-Sample Test for Binomial Proportions (Normal-Theory Test)

To test the hypothesis H_0: $p_1 = p_2$ vs. H_1: $p_1 \neq p_2$, where the proportions are obtained from two independent samples, use the following procedure:

(1) Compute the test statistic

$$z = \frac{\left|\hat{p}_1 - \hat{p}_2\right| - \left(\frac{1}{2n_1} + \frac{1}{2n_2}\right)}{\sqrt{\hat{p}\hat{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

where $\hat{p} = \frac{n_1\hat{p}_1 + n_2\hat{p}_2}{n_1 + n_2} = \frac{x_1 + x_2}{n_1 + n_2}, \hat{q} = 1 - \hat{p}$

and x_1, x_2 are the number of events in the first and second samples, respectively.

TESTS ON PROPORTIONS

(2) For a two-sided level α test,

if $z > z_{1-\alpha/2}$

then reject H_0;

if $z \leq z_{1-\alpha/2}$

then accept H_0.

(3) The approximate p-value for this test is given by

$$p = 2[1 - \Phi(z)]$$

(4) Use this test only when the normal approximation to the binomial distribution is valid for each of the two samples—that is, when $n_1 \hat{p}\hat{q} \geq 5$ and $n_2 \hat{p}\hat{q} \geq 5$.

TESTS ON PROPORTIONS – PROBLEM 4

The set of women with at least one birth was arbitrarily divided into two categories: (1) women whose age at first birth was ≤29 years and (2) women whose age at first birth was ≥30 years. The following results were found among women with at least one birth: 683 of 3220 (21.2%) women with breast cancer (case women) and 1498 of 10,245 (14.6%) women without breast cancer (control women) had an age at first birth ≥30. How can we assess whether this difference is significant or simply due to chance?

TESTS BY EXAMPLE

Objective. To evaluate the impact of musculoskeletal ultrasound (MSUS) as a complementary method to clinical assessment on rapid diagnosis and therapeutic decisions in a busy outpatient rheumatology clinic.
Methods. Sixty patients with different musculoskeletal symptoms were included in the study. Three expert rheumatologists performed the clinical examination and filled out a standardized clinical report sheet with the following parameters: general and/or local diagnoses, planned systemic and/or local treatment, and their decision concerning the use of MSUS evaluation complementary to clinical examination. Another rheumatologist, blinded to clinical data, performed the MSUS assessment of the anatomic areas selected by the clinicians. The impact of the new information obtained by MSUS on the initial diagnosis and therapeutic strategy was estimated by the degree of change in the initial clinical diagnosis and therapy decisions.
Results. Of 60 patients (67 anatomic areas), MSUS was considered as necessary after clinical examination in 39 patients (65%), totaling 43 anatomic areas (64.17%). An overall change of the initial clinical diagnosis was present in 60% of the anatomic areas ($P = 0.0175$). In all of the anatomic areas (100%), the new diagnosis was more objective and detailed. An overall change of the initial systemic therapy was present in 25% of anatomic areas ($P = 0.0014$) and in 36% of anatomic areas ($P = 0.095$) for local therapy. A guided diagnostic aspiration was decided to be performed in 15% of anatomic areas and a guided therapeutic injection in 22% of anatomic areas.
Conclusion. Enhanced information obtained by MSUS evaluation leads to changes, with a significant impact on the initial diagnosis and treatment strategy designed after clinical examination.

Micu MC, Alcalde M, Sáenz JI, Crespo M, Collado P, Bolboacă SD, Naredo E. Impact of musculoskeletal ultrasound in an outpatient rheumatology clinic. Arthritis Care & Research 2013;65(4):615–621.

TESTS BY EXAMPLE

Abstract

Objectives. We hypothesized that adiponectin gene SNP+45 (rs2241766) and SNP+276 (rs1501299) would be associated with atherosclerotic peripheral arterial disease (PAD). Furthermore, the association between circulating adiponectin levels, fetuin-A, and tumoral necrosis factor-alpha (TNF-α) in patients with atherosclerotic peripheral arterial disease was investigated. *Method*. Several blood parameters (such as adiponectin, fetuin-A, and TNF-α) were measured in 346 patients, 226 with atherosclerotic peripheral arterial disease (PAD) and 120 without symptomatic PAD (non-PAD). Two common SNPs of the ADIPOQ gene represented by +45T/G 2 and +276G/T were also investigated. *Results*. Adiponectin concentrations showed lower circulating levels in the PAD patients compared to non-PAD patients ($P < 0.001$). Decreasing adiponectin concentration was associated with increasing serum levels of fetuin-A in the PAD patients. None of the investigated adiponectin SNPs proved to be associated with the subjects' susceptibility to PAD ($P > 0.05$). *Conclusion*. The results of our study demonstrated that neither adiponectin SNP+45 nor SNP+276 is associated with the risk of PAD.

Gherman CD, Pamfil D, Bolboacă SD. Association of Atherosclerotic Peripheral Arterial Disease with Adiponectin Genes SNP+45 and SNP+276: A Case-Control Study. BioMed Research International 2013;Article ID 501203.

TESTS BY EXAMPLE

Abstract. Introduction. Patients with HIV infection develop changes of lipid fractions. These changes are associated with both viral replication and antiretroviral treatments, especially with protease inhibitor treatments. The aim of the present research was to evaluate the specific risk factors of HIV infections for occurrence of lipid metabolism and glycemic metabolism disorders. **Material and method.** A longitudinal prospective study over a period of 34 months was carried out in order to assess 179 patients aged over 18, known or newly diagnosed with HIV infection. In these patients markers for HIV infection (viral load, CD4 cell, stage of disease, ARV treatment), lipid fractions (HDL cholesterol, LDL cholesterol, total cholesterol, triglycerides) and fasting plasma glucose were assessed. Survival studies were performed using the Kaplan Meier method at a significance level of 5%. **Results.** The evaluated group comprised 89 females with an age average of 30 ± 12.6 years and 90 males with an age average of 32.8 ± 12.7 years with or without ARV treatment. Most patients were in stage C3, followed by stage B2 and stage B3 of disease. Fasting plasma glucose proved to be increased in male patients ($p = 0.00258$). HDL cholesterol decrease in time in male patients ($p = 0.00859$), in presence of HIV replication ($p = 0.00010$), and in advanced immune depression ($p = 0.00002$). The HDL cholesterol proved not affected by the type of treatment ($p = 0.52038$). LDL cholesterol increase in presence of HIV replication ($p = 0.000230$, in advance immune depression ($p = 0.03752$), and in advanced stage of disease ($p = 0.01210$)). Total cholesterol was increased in presence of HIV replications ($p = 0.00038$) and in advance immune depression ($p = 0.02560$). Triglycerides increase in advanced HIV infection ($p = 0.01458$). **Conclusions.** Viral replications and advanced immunity depression is associated with decrease HDL-cholesterol and increase LDL-cholesterol and total cholesterol. The lipid fractions and fasting plasma glucose are not affected by the different type of treatment.

Papita A, Itu C, Bolboacă SD. Metabolic Disorder Associated with HIV Infection and Atiretroviral Treatment. Therapeutics, Pharmacology and Clinical Toxicology 2012;XVI(1):24-31.

TESTS BY EXAMPLE

Table 3. Serum and urine NGAL - paired comparisons Wilcoxon test

AKI	Wilcoxon test	NGALs1-NGALs0	NGALs2-NGALs0	NGALs2-NGALs1	NGALu1-NGALu0	NGALu2-NGALu0	NGALu2-NGALu1
Positive	Statistics	-2.429[a]	-1.955[a]	-1.122[b]	-0.653[a]	-0.296[b]	-1.009[b]
	p-value	0.015	0.051	0.262	0.514	0.767	0.313
Negative	Statistics	-3.153[a]	-2.323[a]	-0.660[b]	-0.569[b]	-0.170[a]	-1.023[a]
	p-value	0.002	0.020	0.509	0.570	0.865	0.307

NGALs0 = NGAL serum baseline; NGALs1 = NGAL serum 6h; NGALs2 = NGAL serum 12h;
NGALu0 = NGAL urinar baseline; NGALu1 = NGAL urinar 6h; NGALu2 = NGAL urinar 12h;
a = negative ranks; b = positive ranks;

Mihály O, Bolboacă SD, Rahaian R, Bodolea C, Chira C, Cristea T, Oblezniuc A, Mihály ZA, Coman I. Accuracy of Neutrophil Gelatinase-Associated Lipocalin in Detecting Acute Kidney Injury after Urogenital Robotic Assisted Laparoscopic Surgery under General Anesthesia. Applied Medical Informatics 2012;30(2):47-56.

TESTS BY EXAMPLE

Abstract

Lymphatic and Vascular Invasion in Laryngeal and Pyriform Sinus Carcinomas

Background: To investigate prognostic significance of the lymphatic and vascular invasion in patients with squamous cell carcinoma of the larynx and pyriform sinus.

Material and Methods: Patients with squamous cell carcinoma of the larynx and pyriform sinus who underwent laryngectomies between 2002 and 2006 in the ENT Clinic of Cluj-Napoca were investigated for lymphatic and vascular invasion and their effect on disease-free survival and recurrence rates.

Results: The present study included 396 patients. The mean disease-free survival of patients with or without lymphatic invasion was statistically significant (p=0.000000). The mean disease-free survival of patients with or without vascular invasion was statistically significant (p=0.000021). In multivariant analysis, the lymphatic invasion was significantly correlated only with surgical resection borders (p=0.0004), while vascular invasion was significantly correlated with surgical resection borders (p=0.0000), nodes diameter (p=0.0075) and postoperative radiotherapy and/or chemotherapy (p=0.0002).

Conclusion: Lymphatic and vascular invasion have a significant prognostic value and influence the disease-free survival, regional and distant metastasis rates significantly.

Chirilă M, Bolboacă SD, Mureşan M, Tomescu E, Cosgarea M. Lymphatic and Vascular Invasion in Laryngeal and Pyriform Sinus Carcinomas. Laryngo-Rhino-Otologie 2011;90(6):358-363.

TESTS BY EXAMPLE

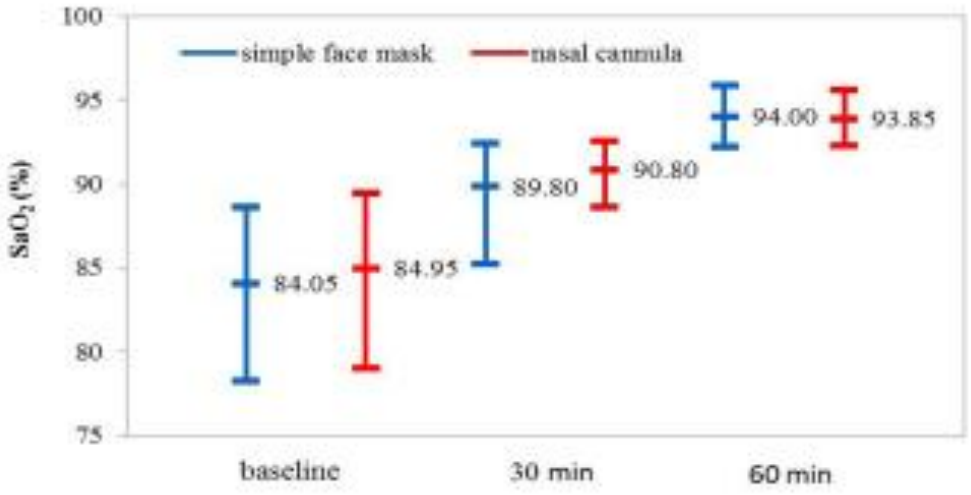


Fig. 2. SaO_2 in moment 0 (baseline), and 30 minutes and 60 minutes after oxygen therapy by simple face mask (blue) and by nasal cannula (red). The middle points represent the value of median while the extreme points are the 25th and 75th percentiles

Tab. 3. Comparison of SaO_2 and SpO_2 in the subjects who were delivered oxygen therapy by simple face mask and nasal cannula

			p-value associated to Sign test		
Group	Variable	Friedman ANOVA (p-value)	Baseline vs. 30 minutes	Baseline vs. 60 minutes	30 minutes vs. 60 minutes
Simple face mask	SaO_2 (%)	66.36 (< 0.001)	$1.36 \cdot 10^{-6}$	$1.36 \cdot 10^{-6}$	$8.64 \cdot 10^{-6}$
	SpO_2 (%)	74.05 (< 0.001)	$1.95 \cdot 10^{-6}$	$1.95 \cdot 10^{-6}$	$1.36 \cdot 10^{-6}$
Nasal cannula	SaO_2 (%)	64.39 (< 0.001)	$5.43 \cdot 10^{-6}$	$5.43 \cdot 10^{-6}$	$5.43 \cdot 10^{-6}$
	SpO_2 (%)	72.00 (< 0.001)	$3.80 \cdot 10^{-6}$	$5.43 \cdot 10^{-6}$	$1.34 \cdot 10^{-6}$

Badiu Tişa ID, Bolboacă S, Miu N, Iacob D. Efficiency of Oxygen Therapy by Simple Face Mask and Nasal Cannula for Acute Respiratory Failure in Infants and Young Children. Notulae Scientia Biologicae 2013;5(4):407-411.

TESTS BY EXAMPLE

Results: Thirty-six patients were included (23 with rheumatoid arthritis, 13 with other inflammatory arthritis). A total of 648 joints were examined. Changes in ultrasound parameters were symmetric, alterations in the right hand being associated with similar changes in the left hand (chi-square and Fischer's test statistically significant, $p \leq 0,009$). A single exception was found: the echogenicity of the proximal interphalangeal joint in the third digit of the right hand, which did not correlate with the same joint in the left hand ($p=0,131$). The associations between global ultrasound parameters were also analyzed: number of joints with synovitis, number of joints with Doppler signal, number of joints with bone erosions, the sum of synovitis' gradings, and the sum of Doppler signal's gradings. The global ultrasound parameters were correlated for the left and right hand ($p<0,05$).

Conclusion: The present study's results support that unilateral ultrasound examination is sufficient in patients with clinically symmetric inflammatory arthritis. Concurrently, this observation needs larger study groups, in order to support more consistently this recommendation.

Key words: ultrasonography, Doppler, inflammatory arthritis, rheumatoid arthritis, synovitis

Boja AR, Tamaş MM, Rednic N, Filipescu I, Bolboacă SD, Rednic S, Mircea PA. Ultrasonography in symmetric hand arthritis: are left and right equivalent?. Romanian Journal of Rheumatology 2011;XX(1):20-26.

TESTS BY EXAMPLE

Table 3. Sonoelastographic parameters for normal distributed variable: results of comparison between case and control group

Param	t-test for Equality of Means						
						95% CI of the Difference	
	t	df	p	MeanDiff [95%CI]	StdErrDiff	Lower	Upper
AvgRed	1.640	373.043	0.102	1.95	1.19	-0.39	4.29
AvgGreen	-2.506	257.183	$1.29 \cdot 10^{-2}$	-3.35	1.34	-5.98	-0.72
DispHue	4.04	261.76	$6.93 \cdot 10^{-5}$	3.76	0.93	1.93	5.59

t = t-value; df = degrees of freedom; MeanDiff = mean of difference;
95%CI = 95% confidence interval for mean difference; StdErrDiff = standard error of difference

Table 4. Sonoelastographic parameters for not normal distributed variable: results of comparison between case and control group

		AvgBlue	AvgIntensity	AvgHue	DispRed	DispGreen	DispBlue	DispIntensity
Most Extreme Differences	Absolute	0.429	0.230	0.694	0.253	0.348	0.106	0.176
	Positive	0.031	0.062	0.156	0.253	0.000	0.079	0.044
	Negative	-0.429	-0.230	-0.694	-0.027	-0.348	-0.106	-0.176
Kolmogorov-Smirnov Z		4.088	2.187	6.608	2.407	3.312	1.011	1.677
p		< 0.001	$1.41 \cdot 10^{-4}$	< 0.001	$1.86 \cdot 10^{-5}$	< 0.001	0.258	0.007

Botar-Jid C, Bolboacă SD, Damian L, Dudea SM, Pantilie C, Nedevschi S, Badea R. Assessment of Sonoelastography as Diagnosis Tool of Inflammatory Myopathies. Applied Medical Informatics 2010;27(4):81-89.

TESTS BY EXAMPLE

Methods: A prospective study with a six-month follow-up was conducted on hypertensive patients with LVH and mild/ moderate essential hypertension. The patients were randomly assigned to Valsartan (80 to 160 mg/day) or Nebivolol (5 to 10 mg/day) groups. The study group consisted of 108 patients, 55 in the Valsartan group and 53 in the Nebivolol group.
Results: The range of mean systolic blood pressure (SBP) varied from 152±17 (baseline) to 132±17 mmHg (follow-up) in the Valsartan group ($p<0.001$); from 146±13 to 125±14 mmHg in the Nebivolol group ($p<0.001$). The decrease in mean diastolic blood pressure (DBP) was 9.5±2.5 mmHg in the Valsartan group and 12.3±5.0 mmHg in the Ne-bivolol group. A significant reduction in QT and corrected QT (Bazett's formula) dispersion was observed in both groups, with a slightly higher reduction in the Valsartan group. Echocardiography showed a decrease in the left ven-tricle mass (LVM) indices ($p<0.05$) in both groups with a greater reduction in the Valsartan group.

Luminita Lăţea, Ştefania L. Negrea, Sorana D. Bolboacă. Effects of valsartan and nebivolol on blood pressure, QT dispersion and left ventricular hypertrophy in hypertensive patients. Dicle Medical Journal 2010;37(2):OA81-88.

TESTS BY EXAMPLE

Objectives: Interleukin 4 plays a critical role in T helper 2 responses to HPV infection and angiogenesis. The present study aim to study the association between the IL4 promoter polymorphism – 590 C>T, respectively VNTR intron 2 polymorphism and cervical intraepithelial neoplasia. *Material and Method:* We have realized a prospective case controls study that included 128 cases of intraepithelial neoplasia positive for HPV HR testing and 111 controls negative for intraepithelial lesion and also negative for HPV HR. Clinical examination was performed on each patient; blood and cervical sample were obtained. Cervical probes were analyzed regarding cytology and HPV HR testing. From peripheral blood DNA sample was obtain followed by genotype analysis for IL4 -590 C>T using PCR RFLP, respectively IL4 70 bp VNTR determined by PCR. *Results:* The absolute frequency of genotypes for IL4 -590 C>T was T/T-5, C/T-42, C/C-81 in the cases group respectively T/T-2, C/T-32, C/C-77 in the control group. The chi-square test had a value of 0.983 (p=0.321) while considering the presence of a minimum one single variant allele as a risk factor for cervical cancer, respectively 0.926 (p=0.336) for homozygous variant genotype. Odds ratio was 0.761 (95%CI [0.443-1.306]) while considering C/T+T/T respectively 2R/3R, 2R/2R as a risk factor, and 0.451 (95%CI 95% [0.086-2.374]) - TT respectively 2R/2R as a risk factor. *Conclusion:* No linear statistical significant association has been found between IL4 polymorphism and cervical neoplasia (p = 0.322).

Rotar I, Bolboacă SD, Mureşan D, Popp R, Petrişor F, Butuza C, Caracostea G, Stamatian F. The Analysis of Genetic Polymorphism. The Relationship between Interleukin – 4 Polymorphisms and Intraepithelial Cervical Neoplasia. Applied Medical Informatics 2010:27(3):43-52.

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HOMEWORK

Solve the problems presented in this lecture (see text in red as Problem) and send the solution as attached file (e-mail: sbolboaca@umfcluj.ro) no later than December 19, 2013. Specify as subject: Full name – Faculty – Group.