



Association of Abdominal Circumference, Body Mass Index and Inflammation in Kidney Transplant Recipients

Kristof Nagy¹; Akos Ujszaszi²; Adam Rempert¹, Csaba P. Kovessy^{3,4}; Istvan Mucsi⁵; Miklos Z. Molnar³ and Zoltan Mathe¹

¹Department of Transplantation and Surgery, Semmelweis University, Budapest, Hungary; ²Department of Pathophysiology, Semmelweis University, Budapest, Hungary; ³Division of Nephrology, Department of Medicine, University of Tennessee Health Science Center, Memphis, TN, USA; ⁴Nephrology Section, Memphis Veterans Affairs Medical Center, Memphis, TN, USA; ⁵Division of Nephrology and Multiorgan Transplant Program, University Health Network and University of Toronto, Toronto, Canada



Background

- Increased abdominal circumference is a marker of obesity and it is associated with increased mortality in renal transplant recipients.
- Recent findings suggest that increased visceral fat deposition is a modifier of inflammation.
- In addition, both obesity and inflammation are important predictors of outcomes, including mortality and graft survival in renal transplant recipients.
- However, little is known about the association of inflammation with abdominal circumference in kidney transplant recipients.
- We hypothesized that increased abdominal circumference and BMI is associated with elevated inflammatory markers.

Methods

- We recruited all **prevalent kidney transplant recipients (n=1,214)**, who were followed at a single transplant outpatient clinic at the Department of Transplantation and Surgery at Semmelweis University Faculty of Medicine in Budapest, Hungary between 2006 and 2007.
- Patients have been excluded if experienced acute rejection within the last 4 weeks before study entry; were hospitalized at the study entry; received kidney transplantation in the previous 3 months; or had acute infection or bleeding.
- Abdominal circumference, body mass index (BMI) and inflammatory markers were measured at baseline.
- Associations of inflammatory markers with abdominal circumference and BMI** were examined using unadjusted cubic spline analyses and also using unadjusted and adjusted multivariable linear regression models.
- We adjusted for nutritional, demographic and transplant data.

Results

	All patients (n=985)	Abdominal circumference ≤88cm in women and ≤102 in men (n=441)	Abdominal circumference >88cm in women and >102cm in men (n=544)
Abdominal circumference (cm)	98.8±14.4	87.4±9.6	108.0±10.6
BMI (kg/m ²)	27.0±4.9	23.5±3.4	29.9±4.0
Age (years)	51±13	47±14	54±11
Gender, female (%)	43	38	47
Presence of HT (%)	94	91	96
Presence of diabetes (%)	21	15	26
Presence of CHD (%)	9	7	10
CCI	2 (2)	2 (1)	2 (2)
Smoking (%)	18	23	15
Total ESRD time (month)	108 (86)	111 (95)	104 (82)
eGFR (ml/min/ 1.73 m ²)	52.6±21.8	53.2±22.7	52.1±21.0
CRP (mg/L)	3.1 (5.2)	2.3 (3.4)	4.2 (6.6)
Interleukin-6 (pg/ml)	2.1 (2.3)	1.9 (2.0)	2.3 (2.7)
TNF α (pg/ml)	2.1 (1.3)	2.1 (1.4)	2.0 (1.3)
WBC count (10 ⁹ /L)	7.9±2.3	7.7±2.3	8.1±2.3
MIS score	3 (3)	3 (3)	3 (2)
Serum albumin (g/L)	40.2±4.1	40.4±4.3	40.1±4.0
Total cholesterol (mmol/L)	5.5±1.3	5.4±1.3	5.6±1.3
LDL cholesterol (mmol/L)	3.2±0.9	3.1±0.9	3.2±0.93
HDL cholesterol (mmol/L)	1.3±0.4	1.4±0.5	1.3±0.4
Triglyceride (mmol/L)	1.7 (1.3)	1.5 (1.1)	1.9 (1.5)

- Mean±SD age was a 51±13 year, 57% were men and 21% were diabetics.
- Patients with abdominal circumference above the median had higher body mass index and were older (mean±SD: 23.9±3.6 vs. 30.1±3.9 kg/m², p<0.001; and 48±14 vs. 54±11 years, p<0.001) (**Table 1**).
- Furthermore patients with higher abdominal circumference had higher inflammatory parameters: median (Inter-Quartile Range) CRP (mg/L): 2.3 (3.9) vs. 4.1 (6.2), p<0.001; and IL6 (pg/mL): 1.9 (2.2) vs. 2.3 (2.4), p<0.001.
- Our results showed a linearly increasing association between abdominal circumference and natural log-transformed (ln) CRP, IL-6 and TNF-α levels, and a threshold-type association with WBC in unadjusted cubic spline analyses (**Figure 1**).
- In multivariable adjusted linear regression models higher abdominal circumference showed significant linear associations with inflammatory markers (standardized regression coefficients (β) of abdominal circumference for lnCRP: β_{abdominal circumference}=0.29, p<0.001; and for lnIL-6: β_{abdominal circumference}=0.09, p=0.018) (**Table 2**).
- Moreover, in multivariable adjusted linear regression models higher BMI showed significant linear associations with inflammatory markers (standardized regression coefficients (β) of BMI for lnCRP: β_{BMI}=0.24, p<0.001; and for white blood cells: β_{BMI}=0.07, p=0.041).

Dependent variables		RC of abdominal circumference	Standardized RC of abdominal circumference	Lower CI 95% of RC	Upper CI 95% of RC
lnCRP	Unadjusted	0.022	0.272	0.017	0.027
	Case-mix	0.023	0.292	0.018	0.029
	Fully-adj.	0.023	0.289	0.018	0.029
WBC	Unadjusted	0.018	0.110	0.008	0.028
	Case-mix	0.012	0.072	0.000	0.023
	Fully-adj.	0.009	0.054	-0.004	0.021
lnIL-6	Unadjusted	0.008	0.137	0.004	0.011
	Case-mix	0.005	0.087	0.001	0.009
	Fully-adj.	0.005	0.085	0.001	0.009
lnTNFα	Unadjusted	0.003	0.078	0.001	0.005
	Case-mix	0.003	0.080	0.000	0.005
	Fully-adj.	0.002	0.066	0.000	0.005

Table 2: Association of abdominal circumference (explanatory variable) and different inflammatory markers (dependent variables) using multilevel and multivariate linear regression analyses in 985 kidney transplant recipients

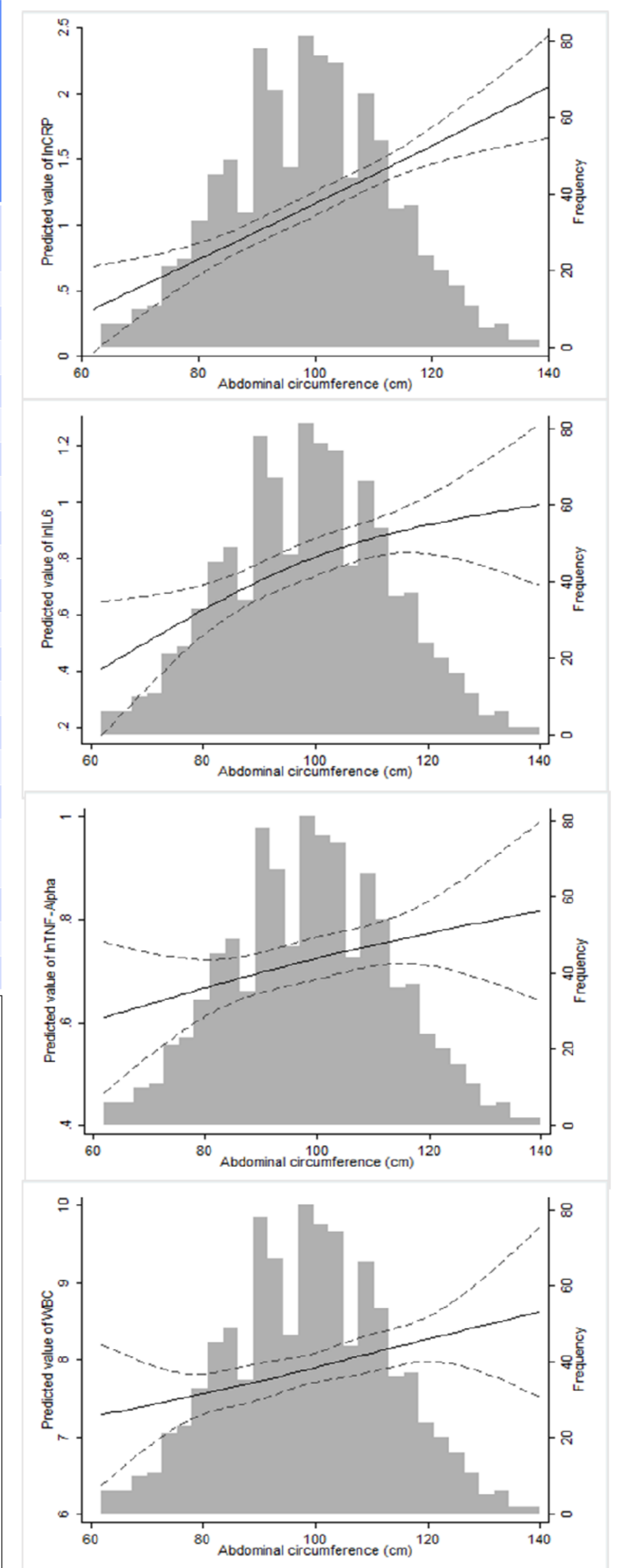


Figure 1: Unadjusted association between abdominal circumference (explanatory variable) and lnCRP, lnIL-6, lnTNFα and WBC (dependent variables) in 985 kidney transplant recipients using linear regression analysis with additional distributional histograms of the inflammatory markers.

Conclusions

- Abdominal circumference and BMI are independently associated with inflammatory markers in prevalent kidney transplant recipients.

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