Assessment of voiding dysfunction in a sample of Iraqi Type 2 Diabetes Mellitus patients

Evaluación de la disfunción miccional en una muestra de pacientes iraquíes con diabetes mellitus tipo 2

Mohammad Amer Abdul-Hussain1 mohammadameralanbari@gmail.com https://orcid.org/0009-0001-8999-208X
Ibrahim Abdullah Mahmood2 M.B.Ch.B. (PhD) ibrahemibrahem73@nahrainuniv.edu.iq https://orcid.org/0000-0003-1943-0329
Laith Amer Al-Anbary3 M.B.Ch.B., Iraqi/Arabic board of Urology laithamer3000@gmail.com https://orcid.org/0009-0007-9279-4774
1Postgraduate student, Department of Physiology, AL-Nahrain University, College of Medicine- Iraq, Baghdad, Iraq.
2Assistant professor, Department of Physiology, AL-Nahrain University, College of Medicine- Iraq, Baghdad, Iraq.
3Assistant professor, Department of Urology, AL-Nahrain University, College of Medicine- Iraq, Baghdad, Iraq.
Address correspondence to Mohammad Amer Abdul-Hussain. E-mail: mohammadameralanbari@gmail.com
Conflict of interest: The authors declare that there is no conflict of interest.
Received: 06/20/2022 Accepted: 09/19/2023 Published: 10/25/2023 DOI: http://doi.org/10.5281/zenodo.10108816

Abstract

Introduction: Type 2 Diabetes Mellitus (T2DM) causes multiple complications in various body systems.

Objective: determination of the effect of the duration of T2DM on the voiding phase of the urination process by using a questionnaire and urodynamic test

Aim of the study: This study focuses on looking into the effect of the duration of T2DM on the voiding phase of the urination process.

Materials and Methods: This cross-sectional research study includes 120 people living with T2DM with voiding dysfunction symptoms were enrolled. The patient's demographics and comorbidities were obtained through a direct interview. Each patient's entire history was recorded. There was a complete urodynamic study test. The patient's urodynamic study results were compared with demographic and clinical variables.

Results: The mean age of the patients was 54.23 + 12.63 years. According to the length of their T2DM duration, patients were generally divided into two groups: those with short disease duration (1.0–10 years) made up roughly three-fourths of the patients (75.83%), and those with long disease duration (>10 years) made up nearly one-fourth of the patients (24.17%).

Subjective symptoms showed a clear significant difference in the score of all included voiding symptoms between the long T2DM duration group and the short duration group. The median score of these symptoms in patients with short T2DM duration ranged from 0.4 (for strain) to 1.0 (for the sensation of incomplete bladder emptying). On the other hand, the median score for these symptoms in patients with long T2DM duration was at least 2.0 (for post-voiding dribbling) and 3.0 for the other symptoms. According to statistics, people with long vs. short T2DM duration groups experienced significantly different in these symptoms, p=<0.001 for all parameters except the sensation of incomplete bladder emptying p=0.001, as shown in (Table 2).

According to urodynamic test results, the median maximum and average flow rates in patients with long-term T2DM duration were 10.9 ml/s and 4.0 ml/s, respectively, while these values were 21.05 ml/s and 9.5 ml/s, respectively, in patients with short-term T2DM duration. These differences were extremely significant, with a p-value of < 0.001 between the two groups. Patients with long duration, on the other hand, showed a significantly greater median of post-void residual volume (PVRV) (150 ml, range= 3.0-1000 ml) than those with short duration (median= 10 ml, range= 0.0-400 ml), with a highly significant difference p=<0.001 (Table 3).

Conclusion. Duration of T2DM for more than ten years increases the possibility of occurrence of Voiding Dysfunction in T2DM patients.

Keywords: Urodynamic Test, Voiding Dysfunction, Type 2 Diabetes Mellitus.

Resumen

Introducción: La Diabetes Mellitus tipo 2 (DM2) causa múltiples complicaciones en diversos sistemas del cuerpo.

Objetivo: determinar el efecto de la duración de la DM2 en la fase miccional del proceso de micción mediante el uso de un cuestionario y una prueba urodinámica.

Objetivo del estudio: este estudio se centra en analizar el efecto de la duración de la DM2 en la fase de micción del proceso de micción.

Materiales y métodos: este estudio de investigación transversal incluye a 120 personas que viven con DM2 y se inscribieron síntomas de disfunción miccional. Los datos demográficos y comorbilidades del paciente se obtuvieron mediante entrevista directa. Se registró la historia completa de cada paciente. Se realizó una prueba de estudio urodinámico completo. Se compararon los resultados del estudio urodinámico del paciente con variables demográficas y clínicas.

Resultados: La edad media de los pacientes fue 54,23 + 12,63 años. Según la duración de la DM2, los pacientes generalmente se dividieron en dos grupos: aquellos con una duración corta de la enfermedad (1,0 a 10 años) constituyeron aproximadamente las tres cuartas partes de los pacientes (75,83%) y aquellos con una duración prolongada de la enfermedad (> 10 años) representaron casi una cuarta parte de los pacientes (24,17%).

Los síntomas subjetivos mostraron una clara diferencia significativa en la puntuación de todos los síntomas miccionales incluidos entre el grupo de DM2 de larga duración y el grupo de corta duración. La puntuación media de estos síntomas en pacientes con DM2 de corta duración osciló entre 0,4 (para tensión) y 1,0 (para sensación de vaciado incompleto de la vejiga). Por otro lado, la puntuación media para estos síntomas en pacientes con DM2 de larga duración fue de al menos 2,0 (para el goteo posmiccional) y 3,0 para los demás síntomas. Según las estadísticas, las personas con grupos de DM2 de larga duración versus corta experimentaron diferencias significativas en estos síntomas, p=<0,001 para todos los parámetros excepto la sensación de vaciado incompleto de la vejiga p=0,001, como se muestra en la (Tabla 2).

Según los resultados de las pruebas urodinámicas, la mediana de los caudales máximo y promedio en pacientes con DM2 de larga duración fue de 10,9 ml/s y 4,0 ml/s, respectivamente, mientras que estos valores fueron de 21,05 ml/s y 9,5 ml/s, respectivamente. en pacientes con DM2 de corta duración. Estas diferencias fueron extremadamente significativas, con un valor de p <0,001 entre los dos grupos. Los pacientes con duración prolongada, por otro lado, mostraron una mediana significativamente mayor de volumen residual posmiccional (PVRV) (150 ml, rango = 3,0-1000 ml) que aquellos con duración corta (mediana = 10 ml, rango = 0,0-1000 ml). 400 ml), con una diferencia altamente significativa p=<0,001 (Tabla 3).

Conclusión: La duración de la DM2 durante más de diez años aumenta la posibilidad de aparición de disfunción miccional en pacientes con DM2.

Palabras clave: Prueba Urodinámica, Disfunción miccional, Diabetes Mellitus tipo 2.

Introduction

Diabetes mellitus is a collection of chronic, progressive, heterogeneous metabolic illnesses defined by hyperglycemia and disordered protein and fat metabolism brought on by defects in insulin production, insulin activity, or both[1]. Type 2 Diabetes Mellitus (T2DM) is the most common form of diabetes, accounting for over 85% of all cases of diabetes mellitus. Type 1 Diabetes Mellitus (T1DM) is the second primary form of diabetes[2]. There is a global epidemic of T2DM, as evidenced by the rising number of individuals who suffer from the disease; approximately 171 million people worldwide had diabetes at the start of the third millennium, while projections for 2030 show that this number will increase to 552 million people[3]. Patients with early onset of the disease are more susceptible to developing diabetes-related complications at a young age because T2DM complications develop according to the age of onset and longer duration of the disease[4].

Voiding dysfunction is a term that covers a wide range of urinary symptoms, including difficulty starting or stopping urine flow, incomplete bladder emptying, a weak stream, frequent need to urinate, post-void dribbling, urinary urgency, and urge incontinence[5]. Several categories, including neurological, anatomical, drug-induced, and idiopathic, can be used to classify the causes of voiding dysfunction[6]. Lower urinary tract symptoms, or LUTS, are a general term used to express voiding dysfunction symptoms; it is used to describe the disorders of urination that would be more elegantly defined as failure to store or empty[7]. Voiding dysfunction symptoms include storage and voiding symptoms. The voiding (emptying) symptoms include poor stream, a sensation of incomplete bladder emptying, strain, intermittent stream, hesitancy, and post-void dribbling[6,8]. Hence, in this study, we aimed to investigate the role of the duration of T2DM on the development of voiding dysfunction symptoms.

Study design and setting

One hundred twenty people with T2DM admitted to the urodynamic clinic at Nursing Home Hospital in Baghdad Medical City made up this cross-sectional study between December 2022 and June 2023. Participants in this study had to have symptoms of voiding dysfunction and had been previously diagnosed with T2DM.

Inclusion criteria: Age (18-77) years old, was diagnosed with T2DM according to World Health Organization criteria, presenting lower urinary tract symptoms (voiding symptoms)

Exclusion criteria: Patients with end-stage renal disease, any drug has a track record of impairing bladder or sphincter function, Patients with bladder or prostate tumors, T2DM patients with acute metabolic complications, a history of genitourinary surgery, women who previously had a uterine fibroid diagnosis, Patients having an active urinary tract infection at the time of examination, patients with a history of any renal system stones, and research participants who declined to participate.

Ethical consideration

Before data collection, participants signed a consent form after being informed about the study's goals. Each patient was given the complete freedom to leave at any time. Patients were assured that their data would only be utilized for research during the experiment while data confidentiality would still protected.

Data collection

The study was started by taking proper history from the patient himself, according to inclusion and exclusion criteria, during direct interviews, patient demographics including age, gender, and T2DM duration, as well as major complaints and comorbidities, are obtained. And each patient had answered a questionnaire about his medical history and voiding dysfunction symptoms, Mid-stream urine sample for making general urine examination for the patient if he had positive result for general urine examination he will be excluded, patient is asked to urinate in toilet and immediately Patient submitted for urodynamic test by insertion triple lumen vesical catheter size 9French with aspiration of any post-void residual, Start filling the bladder with normal saline solution in a rate of 20-30ml/min with continuous asking the patient about his sensations ,the filling phase is ended when the patient is no longer able to hold his urine or by decision of the urology specialist when the patient has sever decrease in bladder sensations and the volume of normal saline solution reaches supra-physiological and pathological values, in voiding phase the patient is asked to urinate in uroflowmetery and the urination data is integrated by the computer to asses urine max flow rate and average flow rate .then immediately after uroflowmetery, abdominal ultra sound was done by using 3.5 MHz ultra sound device to assess the post-void residual volume (P.V.R.V.) .

Statistical analysis

The statistical analyses were done using SPSS software, version 25.0 (SPSS, Chicago). To check the normality of continuous data, the Shapiro-Wilk test was employed. Data with a normal distribution were shown as mean and SD. And Student t-test was used to analyse them. Mann Whitney U test analysis was used on data with non-normal distribution, and the results were provided as median and range. The chi-square test was used to examine categorical variables that were reported as numbers and percentages. The potential link between urodynamic measures and demographic and clinical results was investigated using Spearman's correlation test.

Results

One hundred twenty patients with symptoms of voiding dysfunction participated in the study. Table 1 lists the patient's demographic information. The age of the patients varied between 22 and 77 years, with a mean age of 54.23±12.63. Slightly more than half of them (56.67%) were females. The mean disease duration was 7.14±5.46 years, ranging from 1 to 30 years.

Figure 1 distribution of patients according to T2DM duration

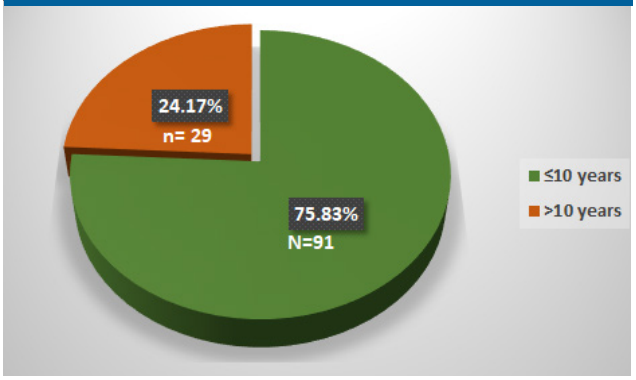

Table 1: Baseline Patients Clinical and Demographic Characteristics (n=120)

Variables	Values
Age, years	
Mean±SD	54.23±12.63
Range	22-77
Gender	
Male	52(43.33%)
Female	68(56.67%)
Disease duration, years	
Mean±SD	7.14±5.46
Range	1.0-30

According to the duration of the disease, patients were divided into two groups: those with short disease duration (1.0–10 years), who made up about three-fourths (75.83%) of the patients, and those with long disease duration (>10 years), who made up about one-fourth (24.17%) of the patients, as shown in figure 1.

Association of voiding Symptoms with T2DM Duration

Data regarding voiding symptom scores were expressed as median and range because it were found to be non-normally distributed and analyzed with a non-parametric Mann-Whitney U test. There was a significant difference in the score of all included voiding symptoms between the long T2DM duration group and the short duration group. The median score of these symptoms in patients with short T2DM duration ranged from 0.4 (for strain) to 1.0 (sensation of incomplete bladder emptying). On the other hand, the median score for these symptoms in patients with long T2DM duration was at least 2.0 (for post-voiding dribbling) or 3.0 for the other symptoms. Statistically, there were highly significant differences in these symptoms between patients with long vs. short T2DM duration p=<0.001 for all parameters, except for the sensation of incomplete bladder emptying p=0.001, as shown in (Table 2).

Table 2: Association of voiding symptoms with T2DM duration

Variables	Short duration (n=91)	Long duration (n=29)	Total (n=120)	p-value
Poor stream Mean± SD Median Range	0.71±1.34 0.75 0.0-5.0	3.1±1.5 3.0 0.0-5.0	1.29±1.71 1.0 0.0-5.0	**<0.001**
Hesitancy Mean± SD Median Range	0.65±1.06 0.5 0.0-4.0	2.62±1.35 3.0 0.0-5.0	1.13±1.41 1.0 0.0-5.0	**<0.001**
Strain Mean± SD Median Range	0.4±0.89 0.4 0.0-4.0	2.79±2.11 3.0 0.0-5.0	0.98±1.65 1.0 0.0-5.0	**<0.001**
Intermittent stream Mean± SD Median Range	0.53±1.07 0.5 0.0-5.0	3.1±1.63 3.0 0.0-5.0	0.98±1.65 1.0 0.0-5.0	**<0.001**
Post-voiding dribbling Mean± SD Median Range	0.74±1.03 0.5 0.0-4.0	1.97±1.61 2.0 0.0-50	1.03±1.3 1.0 0.0-5	**<0.001**
sensation of incomplete bladder emptying Mean± SD Median Range	1.56±1.26 1.0 0.0-4.0	2.62±1.84 3.0 0.0-5.0	1.82±1.48 2.0 0.0-5.0	**0.001**

Association of voiding Urodynamic test findings with T2DM duration

The median of maximum and average flow rate in patients in the long T2DM duration group was 10.9 ml/s and 4.0 ml/s, respectively, compared with 21.05 ml/s and 9.5 ml/s, respectively in those in the short T2DM duration group, with highly significant differences p=< 0.001. In contrast, patients with long duration displayed a much higher median of post-void residual volume (PVRV) (150 ml, range= 3.0-1000 ml) than those with short duration (median= 10 ml, range= 0.0-400 ml) with a p-value of <0.001 which indicate a highly significant difference (Table 3).

Table 3: Association of Voiding Urodynamic Tests Findings with T2DM Duration

Variables	Short duration (n=91)	Long duration (n=29)	Total (n=120)	p-value
Max flow rate, ml/s Mean± SD Median Range	20.97±7.42 21.05 8.0-42.97	11.37±6.18 10.9 0.54-24.96	18.65±8.23 18.15 0.54-42.97	**<0.001**
Average flow rate, ml/s Mean± SD Median Range	10.08±3.95 9.5 2.3-17.2	4.18±3.02 4.0 0.04-11.2	8.66±4.51 8.9 0.04-17.2	**<0.001**
PVRV Mean± SD Median Range	34.57±72.22 10.0 0.0-400	334.59±341.1 150 3.0-1000	107.1±219 11.0 0.0-1000	**<0.001**

Discussion

In our study, The Mean± SD of the age of the patients was (54.23±12.63) years, as shown in Table 1. This finding was consistent with[9] conclusions about cystopathy among Iraqi diabetic patients, who showed that the Mean± SD age of the patients was (56.50±15.50) years. Also, the findings were in accordance with[10] in his study on lower urinary tract symptoms in women with T2DM; in that study, the Mean± SD age of the participants was 55.1±12.37 years.

Regarding the gender, Table 1 indicated that 56.67% of the patients were female. This outcome was consistent with[11], who reported in their study that women were more likely than men to have LUTS (57% vs. 43%, respectively). Additionally[12], documented that LUTS are more common in females than males (84% vs. 80%). Furthermore[13], stated that about 50% of males and nearly 60 % of females have symptoms with urine storage and LUTS.

In the current study, it has been found that the Mean ±SD of disease duration is 7.14±5.46 years, as presented in

Table 1. This result agrees with[15], where they found that Lower urinary tract symptoms (LUTS) are common in diabetes individuals and constitute a latent and puzzling morbidity. Patients with diabetes mellitus experience complex LUTS pathogenesis. As a result, it takes time to appear or be noticed. Furthermore[14], discovered that age and diabetes duration of more than nine years were predictors of bladder dysfunction in Turkish female patients with LUTS and diabetes.

In this study, Patients were categorized broadly into two groups according to T2DM duration: those with short T2DM duration (1.0-10 years) and those with long T2DM duration (>10 years), as shown in Figure 1.

This distribution was in harmony with[15], where they stated that a 10-year cutoff was the optimal cutoff point based on earlier research that indicated people with diabetes for more than 10 years had a greater frequency of diabetic cystopathy.

Table 2 clarified that there were highly significant differences in subjective symptoms between patients in the long T2DM duration group vs. those in the short T2DM duration group.

The results agreed with[16] in their study on 115 men and 68 women about Patients with diabetic cytopathy. They presented that the mean duration of diabetes was 58.45 ±16 months, while the mean duration of voiding symptoms was 27.4 2±9 months. So, voiding dysfunction symptoms in diabetic patients is a time–dependent. Furthermore[17], cite studies that demonstrate LUTS is a common issue for diabetics. The effects of having high blood glucose levels and nerve damage (autonomic neuropathy) that supports the structures of the urinary tract are the most important causes. Consequently, the irreversible damage of nerves causes voiding dysfunction symptoms in patients with long T2DM duration.

In the early stages of bladder involvement in diabetic patients, there is an increase in bladder capacity but no urine retention; therefore, Patients with diabetes may wait until later in the course of the disease to seek medical assistance for urinary tract issues when bladder function has deteriorated and resulted in urine retention and infection. At that time, patients might experience partial bladder emptying, weak stream, dribbling, and urine hesitation[18]. This supports the results of the current study and explains why voiding dysfunction symptoms are more common in the long T2DM duration group.

As illustrated in Table 3, the median of the maximum and average urine flow rate in patients in the long T2DM duration group was lower than the median of the maximum and average urine flow rate in the short T2DM duration group, with a significant difference. As opposed to that, patients in long duration T2DM group displayed a much higher median of PVRV than patients in short duration T2DM group with a highly significant difference.

These results coincide with[19]**.** According to their research on the long-term effects of T2DM on voiding function in rat models, diabetic rats displayed typical diabetic voiding dysfunction. Additionally, the researchers claim that the diabetic rats have decreased bladder afferent pathway activity and a broken urethral relaxation mechanism, which affect the mechanisms of urination and result in a decrease in max and average flow rates.

Additionally, a greater post-void residual volume was linked to a T2DM diagnosis that had been present for longer than 10 years, as stated by[15]**.** Furthermore[20], claims that having a history of diabetes mellitus could significantly increase the risk of getting abnormal post-void residual volume.

References

1. Mahmood IA, Al-Mayah QS. The T allele of TCF7L2 rs12255372 G/T Variant Can Predispose to Type 2 Diabetes Mellitus among Iraqi Population. Trop J Nat Prod Res. 2020 Sep 1;4(9):535–9.
2. Forouhi NG, Wareham NJ. Epidemiology of diabetes. Vol. 47, Medicine (United Kingdom). Elsevier Ltd; 2019. p. 22–7.
3. Moradi F, Ziapour A, Abbas J, Najafi S, Rezaeian S, Faraji O, et al. Comparing the Associated Factors on Lifestyle Between Type 2 Diabetic Patients and Healthy People: A Case-Control Study. Int Q Community Health Educ. 2021;
4. Santos J, Vieira L, Pionorio M, Silva I. Diabetes mellitus in Brazil: risk factors, classification and complications. Int J Med Rev Case Reports. 2019;(0):1.
5. Pesonen JS, Vernooij RWM, Cartwright R, Aoki Y, Agarwal A, Mangera A, et al. The Impact of Nocturia on Falls and Fractures: A Systematic Review and Meta-Analysis. J Urol [Internet]. 2020 Apr 1 [cited 2023 Mar 29];203(4):674–83. Available from: https://www.auajournals.org/doi/10.1097/JU.0000000000000459
6. Russo E, Caretto M, Giannini A, Bitzer J, Cano A, Ceausu I, et al. Management of urinary incontinence in postmenopausal women: An EMAS clinical guide. Maturitas. 2021 Jan 1;143:223–30.
7. Parsons JK, Dahm P, Köhler TS, Lerner LB, Wilt TJ. Surgical Management of Lower Urinary Tract Symptoms Attributed to Benign Prostatic Hyperplasia: AUA Guideline Amendment 2020. J Urol. 2020 Oct 1;204(4):799–804.
8. Sekido N. Management of neurogenic lower urinary tract dysfunction due to spinal cord injury. Diagnosis Treat Spinal Cord Inj. 2022 Jan 1;273–86.
9. Abdul-Hameed SA, Bassil Ismail M. The incidence of Diabetic Cystopathy among Iraqi Diabetic Patients with lower Urinary Tract Symptoms. Vol. 16, Indian Journal of Forensic Medicine & Toxicology. 2022.
10. Yilmaz SD, Bal MD, Celik S, Rathfisch G, Kizilkaya Beji N, Dinccag N, et al. Lower urinary tract symptoms in women with type 2 diabetes mellitus. In: Journal of Wound, Ostomy and Continence Nursing. Lippincott Williams and Wilkins; 2016. p. 523–8.
11. Przydacz M, Golabek T, Dudek P, Lipinski M, Chlosta P. Prevalence and bother of lower urinary tract symptoms and overactive bladder in Poland, an Eastern European Study. Sci Rep. 2020 Dec 1;10(1).
12. Kogan MI, Zachoval R, Özyurt C, Schäfer T, Christensen N. Epide-

miology and impact of urinary incontinence, overactive bladder, and other lower urinary tract symptoms: Results of the EPIC survey in Russia, Czech Republic, and Turkey. Curr Med Res Opin. 2014 Oct 1;30(10):2119–30.

13. Abdelmoteleb H, Jefferies ER, Drake MJ. Assessment and management of male lower urinary tract symptoms (LUTS). Int J Surg [Internet]. 2016 Jan 1 [cited 2023 Jul 26];25:164–71. Available from: https://www.healthline.com/health/lower-urinary-tract-symptoms

14. Kebapci N, Yenilmez A, Efe B, Entok E, Demirustu C. Bladder dysfunction in type 2 diabetic patients. Neurourol Urodyn. 2007;26(6):814–9.

15. Malik RD, Cohn JA, Volsky J, Garvey S, Chang C, Bales GT, et al. A modern comparison of urodynamic findings in diabetic versus nondiabetic women. Female Pelvic Med Reconstr Surg. 2020 Jan 1;26(1):44–50.

16. Kaplan SA, Te AE, Blaivas JG. URODYNAMIC FINDINGS IN PATIENTS WITH DIABETIC CYSTOPATHY. Vol. 153, AhlEnICAK UKuLOGIChL kSSWlhTION. INC. 1995.

17. Wittig L, Carlson K V., Andrews JM, Crump RT, Baverstock RJ. Diabetic Bladder Dysfunction:A Review. Urology. 2019 Jan 1;123:1–6.

18. Starer P, Libow L. Cystometric evaluation of bladder dysfunction in elderly diabetic patients. Arch Intern Med [Internet]. 1990;150(4):810–3. Available from: http://archinte.jamanetwork.com/

19. Matsumoto Y, Torimoto K, Matsuyoshi H, Hirayama A, Fujimoto K, Yoshimura N, et al. Long-term effects of diabetes mellitus on voiding function in a new model of type 2 diabetes mellitus, the Spontaneously Diabetic Torii (SDT) rat. Biomed Res. 2009;30(6):331–5.

20. Wicaksono I, Rahardjo HE. Factors Associated With Postoperative Voiding Dysfunction Post Renal Transplantation. Transplant Proc [Internet]. 2020;52(10):3197–203. Available from: https://doi.org/10.1016/j.transproceed.2020.04.1817