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Fibroscan Assessment of Hepatic Fibrosis in Type 2 Diabetic Patients: A Prospective Study from Southern Morocco

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Abstract **Original Research Article**

Introduction: Metabolic dysfunction-associated steatotic liver disease (MASLD) is highly prevalent among patients with type 2 diabetes (T2DM), with a reported risk of up to 55%. It may progress to advanced fibrosis or cirrhosis. Current guidelines recommend systematic screening for liver fibrosis in this high-risk population. The aim of this study was to assess the severity and prevalence of hepatic fibrosis in T2DM patients using FibroScan, to identify associated risk factors, and to analyze the correlation with the FIB-4 score. ***Patients and Methods:*** A prospective study was conducted at Hassan II Hospital in Agadir between December 2023 and February 2025, including 100 patients with T2DM. All participants underwent abdominal ultrasound followed by FibroScan for liver stiffness measurement. Data were collected using a structured extraction form and analyzed with Jamovi software. ***Results:*** The study included 100 patients with a female predominance (74%) and a mean age of 54.6 years. Body mass index (BMI) was above 25 kg/m² in 80% of participants, with a mean BMI of 29.3 kg/m². A history of hypertension, dyslipidemia, and smoking was reported in 52%, 36%, and 20% of patients, respectively. Mean liver stiffness measured by FibroScan was 6.7 kPa. Significant hepatic fibrosis was associated with higher BMI and waist circumference, greater frequency of hepatic steatosis, longer duration of diabetes, and poor glycemic control ($p < 0.05$). Regarding the FIB-4 score, 74% of patients had a score <1.3, 20% between 1.3 and 2.67, and 6% >2.67. Discordance between FIB-4 and FibroScan results was observed, including false positives and false negatives. ***Conclusion:*** This study highlights the high prevalence of MASLD and hepatic fibrosis in T2DM patients. The main risk factors identified were obesity, increased waist circumference, longer diabetes duration, and poor glycemic control. Although FIB-4 is a useful initial tool, its diagnostic limitations underscore the need for cautious interpretation and complementary assessment with FibroScan.

Keywords: Metabolic dysfunction-associated steatotic liver disease, Type 2 diabetes mellitus, Hepatic fibrosis, FibroScan, FIB-4 score, Obesity.

I. INTRODUCTION

Metabolic dysfunction–associated steatotic liver disease (MASLD) has emerged as the most common chronic liver disease worldwide, with its global prevalence increasing by nearly 50% over the past three decades, reaching an estimated 38.2% between 2016 and 2019 [1]. Despite this alarming trend, MASLD remains largely underdiagnosed and under-referred, with fewer than 10% of patients being evaluated by a specialist [2].

MASLD encompasses a spectrum of hepatic conditions ranging from simple steatosis without significant inflammation to metabolic dysfunction–associated steatohepatitis (MASH, formerly known as nonalcoholic steatohepatitis, NASH). MASH is characterized by steatosis associated with hepatocellular injury (ballooning of hepatocytes) and inflammation, ultimately leading to the development of fibrosis [3,4]. The risk of cirrhosis-related complications and liver-related mortality rises substantially with the onset of advanced fibrosis [5].

Diabetes mellitus represents a major global public health concern. In 2021, an estimated 537 million individuals were living with diabetes worldwide, a number projected to rise to 643 million by 2030 and 783 million by 2045. The severity of diabetes stems primarily from its chronic hyperglycemia–induced complications, with over 6.7 million diabetes-related deaths reported among adults aged 20–79 in the same year [6].

The presence of MASLD is strongly linked to type 2 diabetes (T2D), obesity, and other cardiometabolic risk factors [3]. T2D is a major risk factor for the development of MASH [7]. Patients with MASLD and T2D are at significantly increased risk of progressive chronic liver disease, with estimated prevalences of MASH, advanced fibrosis, and cirrhosis of 58%, 38%, and 10%, respectively [8]. This high-risk population requires systematic screening for fibrosing MASH. The coexistence of these two conditions adversely impacts the natural history and prognosis of both diseases, as both are closely tied to underlying insulin resistance. Moreover, T2D is frequently associated with an increased risk of hepatocellular carcinoma [9,10].

II. PATIENTS AND METHODS

A. Study Design and Participants:

Study population:

This was a prospective, single-center study conducted at Hassan II Regional Hospital in Agadir over a three-month period, from December 2023 to February 2025, including a sample of 100 patients.

Inclusion criteria:

Patients with type 2 diabetes followed in the endocrinology department and admitted to the day hospital of the gastroenterology unit at Hassan II Hospital in Agadir for liver assessment.

All patients underwent abdominal ultrasound prior to FibroScan. Hepatic fibrosis was assessed by liver stiffness measurement (LSM) using a FibroScan 502 device equipped with M/XL probes.

Exclusion criteria:

Patients with type 1 diabetes.

Patients with cirrhosis due to non-MASH etiologies.

B. Data Collection:

Data were collected using pre-established case report forms. For each patient, the following information was obtained:

- Epidemiological and clinical data
- Anthropometric data
- Biological data

Assessment of hepatic fibrosis using noninvasive tools:

Fibrosis-4 (FIB-4) index: calculated for all patients based on age, AST, ALT, and platelet count. This score serves as a rapid screening tool for liver fibrosis in patients with steatosis.

FibroScan: all patients underwent FibroScan evaluation at the day hospital of the hepatogastroenterology unit, aiming to diagnose and quantify hepatic fibrosis in patients with type 2 diabetes. Ultrasound findings: screened for signs of chronic liver disease, hepatic steatosis, and portal hypertension.

C. Statistical Analysis:

Quantitative variables were expressed as means with standard deviations or as medians with interquartile ranges, while qualitative variables were expressed as frequencies and percentages.

Patients were stratified into two groups according to FibroScan results: those with hepatic fibrosis and those without.

Logistic regression analysis was used to identify risk factors associated with hepatic fibrosis. A p-value of <0.05 was considered statistically significant. Statistical analyses were performed using JAMOVI software (version 1.6).

III. RESULTS

The study population included 100 patients with a mean age of 54.6 ± 10.3 years. A marked female predominance was observed (74%). The median duration of diabetes was 15 years. Nearly half of the patients had arterial hypertension (52%), while more than one-third had dyslipidemia (36%). Smoking was reported in 20% of cases.

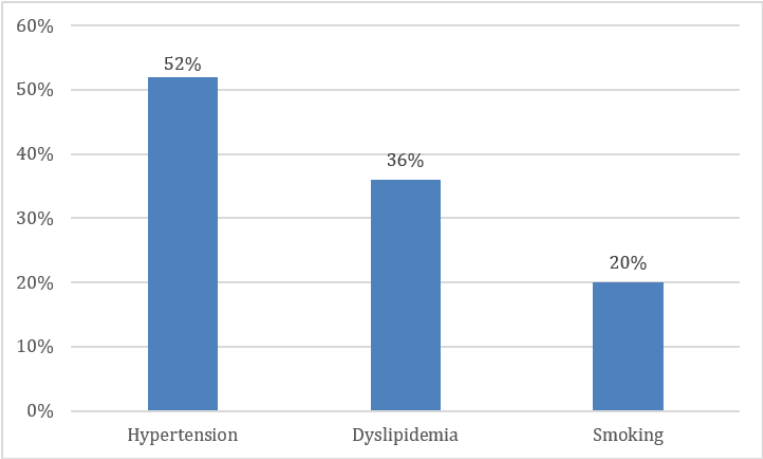

Figure 1: Distribution of patients according to medical history

The mean body mass index (BMI) was 29.3 ± 3.8 kg/m², indicating that the cohort was globally overweight. Waist circumference was also elevated, confirming a high prevalence of abdominal obesity. Glycemic control was inadequate in 43% of patients, with HbA1c values > 7.5%.

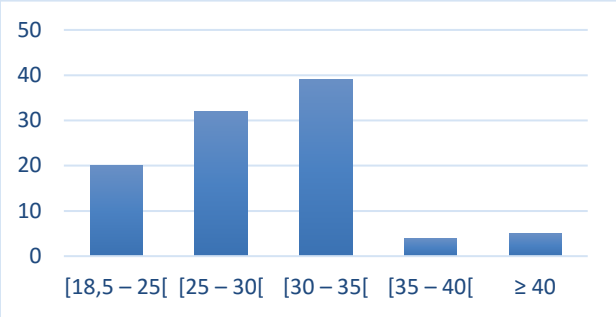

Figure 2: Distribution of patients according to BMI

Abdominal ultrasound revealed hepatic steatosis in 34% of cases. The mean liver stiffness measurement (LSM) on FibroScan was 6.7 kPa. Sixteen patients (16%) had significant fibrosis (≥ F2), including 8 cases of cirrhosis (8%).

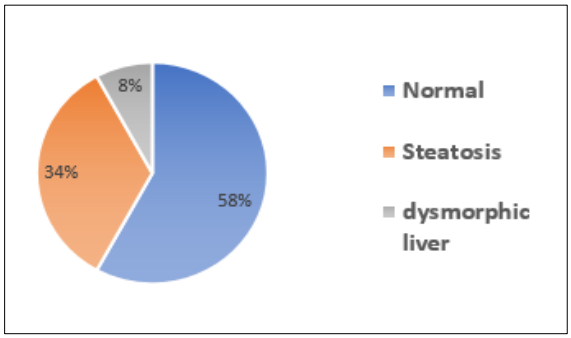

Figure 3: Distribution of patients according to ultrasound findings

The mean liver stiffness measurement (LSM) obtained by FibroScan was 6.7 kPa, with values ranging from 4.0 to 22.0 kPa [4.0–22.0]. An LSM greater than 8 kPa was observed in 16% of patients (n = 16), including 6% with significant fibrosis, 2% with advanced fibrosis, and 8% with cirrhosis.

Table 1: FibroScan results

Fibroscan value	<8 kPa	[8-10] kPa	[10-13] kPa	>13 kPa
n (%)	84 (84%)	6 (6%)	2 (2%)	8 (8%)

Significant factors associated with the presence of fibrosis were longer diabetes duration, poor glycemic control, higher BMI, and increased waist circumference ($p < 0.05$). In contrast, sex and age were not significantly correlated with fibrosis severity.

Table 2: Demographic and anthropometric data in both groups

	Group with liver fibrosis	Group without liver fibrosis	P value
Number (Total=100)	16 (16%)	84 (84%)	
Age	54.38 ± 11.36	54.73 ± 13.95	0.989
Sex Woman Man	 11 (68.7%) 5 (31.2%)	 48 (57.1%) 36 (42.8%)	 1
BMI	36.1 ± 9.4	28.1 ± 4.9	0.009
Waist circumference	109 ±15	93 ±12	0.003
Smoking	5 (30%)	9 (10.7%)	1
Duration of diabetes (years)	17.7 +/- 6.4	13.3 +/- 7.7	0.04
Blood sugar imbalance	13 (81.2%)	32 (38%)	0.003

FIB-4 was < 1.3 in 74% of patients, intermediate in 20%, and > 2.67 in 6%. However, a notable discordance with FibroScan was observed: 10% false negatives and 33% false positives. These findings confirm that FIB-4 alone is insufficient for accurately identifying patients at risk of advanced fibrosis.

Table 3: Correlation between FIB-4 score and FibroScan results

	Fib 4 <1.3 (n=74)	2.67< Fib 4 < 1.3 (n=20)	Fib 4 >2.67 (n=6)
Fibroscan <8 kPa (n=84)	66 (66%)	16 (16%)	2 (2%)
Fibroscan [8-10] kPa (n=6)	6 (6%)	0	0
Fibroscan [10-13] kPa (n=2)	2 (2%)	0	0
Fibroscan >13 kPa (n=8)	0	4 (4%)	4 (4%)

IV. DISCUSSION

1. Prevalence of Steatosis in Patients with Type 2 Diabetes:

Metabolic dysfunction-associated steatotic liver disease (MASLD) is currently the leading cause of chronic liver disease worldwide, with a prevalence estimated between 20% and 30% in the general population. In patients with type 2 diabetes, this prevalence is even higher, often exceeding 50%, due to the strong association between insulin resistance, visceral obesity, and hepatic steatosis. Progression to metabolic dysfunction-associated steatohepatitis (MASH) exposes patients to an increased risk of advanced fibrosis, cirrhosis, and hepatocellular carcinoma, hence the importance of early screening in this high-risk population [7].

In Morocco, few recent studies have specifically addressed NAFLD in type 2 diabetic patients, and available data remain fragmented [11]. In our series, the prevalence of steatosis was 34%, which is lower than the rates reported in most international studies. Several hypotheses may explain this discrepancy: methodological differences, the limited sensitivity of ultrasonography, and specific characteristics of our study population. Interestingly, Tada *et al.,*[12] reported a similar prevalence (34%) using visual ultrasound diagnosis, which aligns our findings with some published standards.

Moreover, the literature emphasizes that the prevalence of NAFLD varies depending on the diagnostic tools used [13]. While liver biopsy remains the gold standard, its invasive nature limits its clinical use. Abdominal ultrasound, although widely available, lacks sensitivity when fat infiltration is below 33% [40]. FibroScan, with the controlled attenuation parameter (CAP), is now considered the preferred tool, combining simplicity, reproducibility, and strong diagnostic performance [14]. Recent international recommendations advocate its systematic use for screening steatosis in type 2 diabetic patients [15].

Table 4: Prevalence of hepatic steatosis in type 2 diabetics across different studies based on ultrasound findings:

Study	Normal ultrasound	Hépatic steatosis
Targher *et al.,* [16]	25,4%	69,5%
Williamson *et al.,* [17]	40,1%	56,9%
Dvorak *et al.,* [18]	21%	66%
Tada *et al.,* [12]	60,1%	33,7%
Sporea *et al.,* [19]	21%	64%
Our study	**58%**	**34%**

2. Prevalence of Hepatic Fibrosis:

In our study, 16% of patients presented with significant fibrosis (≥ 8 kPa on FibroScan), a proportion consistent with the literature, where figures range between 12% and 32%. This finding confirms the need for systematic screening of hepatic fibrosis in diabetic patients, particularly those over 50 years of age.

For comparison, Jacqueminet *et al.,*[20] reported a prevalence of severe fibrosis of 5.6% using FibroTest, with elastography confirmation in only 2.8% of patients. These differences could be related to sample size, inclusion criteria, and diagnostic methods used. In our population, the higher prevalence may reflect a greater burden of metabolic comorbidities and a longer duration of diabetes.

Table 5: Prevalence of hepatic fibrosis in type 2 diabetics across different studies based on FibroScan results:

Study	effective	Prevalence of advanced fibrosis
Kwok *et al.,* [21]	1886	17,7%
Ciardullo *et al.,* [22]	825	15,4%
Mikolasevic *et al.,* [23]	679	12,6%
Vigano *et al.,* [24]	1338	32%
Jordan *et al.,* [25]	1153	22%
Sporea *et al.,* [26]	534	19,4%
Graupera *et al.,* [27]	1150	29%
Our study	**100**	**16%**

3. Risk Factors Associated with Hepatic Fibrosis:

Age: The mean age of our population was 54 years. Unlike many studies demonstrating increased fibrosis with age, we did not observe a statistically significant correlation. This may be explained by the small sample size and the relative homogeneity of the age range in our cohort [29].

Sex: Our series showed a female predominance, without significant correlation between sex and fibrosis. However, the literature describes hormonal influences, with higher prevalence in men before the age of 50, which tends to equalize after menopause [28, 30].

Glycemic control and duration of diabetes: These parameters emerged as major determinants. In our study, poor glycemic control (elevated HbA1c) increased the risk of fibrosis nearly tenfold, while each additional year of diabetes increased this risk by 22% [33]. These findings corroborate those of Bril, Cusi, and Ismaili [31, 38], who identified both diabetes duration and poor glycemic control as independent predictors of NAFLD progression and fibrosis.

Obesity and waist circumference: The mean BMI in our cohort was high (36.1 kg/m²), confirming the major role of obesity in NAFLD pathogenesis. The mean waist circumference was 109 cm, also representing a significant risk factor, sometimes more predictive than BMI. Several studies have highlighted that abdominal adiposity is a better predictor of fibrosis than BMI alone [31, 32, 34, 35].

Transaminases (ALT): We found no significant association between elevated ALT levels and fibrosis. Although some studies have reported such a correlation, most evidence suggests that liver enzymes lack sensitivity and cannot independently identify significant fibrosis. Nevertheless, elevated ALT may serve as a warning sign requiring further evaluation.

4. Correlation Between FIB-4 Score and FibroScan:

An important aspect of our work is the comparison between FibroScan and the FIB-4 score. Although FIB-4 is useful as a first-line tool due to its simplicity, its sensitivity and specificity are limited. In our series, one-third of patients classified as at risk by FIB-4 did not have significant fibrosis on FibroScan, highlighting the need for confirmation using more specific methods. Conversely, some patients categorized as low risk by FIB-4 had advanced fibrosis on FibroScan, raising the risk of underdiagnosis if FIB-4 is used in isolation.

Table 6: Correlation between FibroScan results and FIB-4 scores:

Study	False Negatives FIB-4 <1,3	False Positives >2,67
Trivedi *et al.,* [37]	13%	10,9%
Ciardullo *et al.,* [22]	18%	17,2%
Jordan *et al.,* [25]	14%	16%
Vigano *et al.,* [39]	17% (3%)	11%
Graupera *et al.,* [36]	16% (4,5%)	17,1%
Our study	**10,8% (2,7%)**	**33,3%**

Our findings emphasize the importance of a combined diagnostic algorithm using both simple scores and FibroScan, to better identify patients requiring closer follow-up or specific management.

5. Study Limitations:

Our study has several limitations, including its monocentric design, relatively small sample size, short inclusion period, absence of histological confirmation by liver biopsy, and the unavailability of CAP for precise quantification of steatosis.

Nevertheless, this work represents one of the first Moroccan series highlighting the prevalence and risk factors of hepatic fibrosis in type 2 diabetic patients, providing a useful contribution to regional data.

V. CONCLUSION

Metabolic dysfunction-associated steatotic liver disease (MASLD) is frequent and concerning among patients with type 2 diabetes. Our study shows that nearly one in six patients presents with significant fibrosis and almost one in ten with cirrhosis, conditions that are often underdiagnosed. FibroScan proves to be a reliable tool, complementary to simple scores such as FIB-4, which should not be used in isolation.

We recommend systematic screening for hepatic fibrosis in all patients with type 2 diabetes, combining non-invasive scoring systems with elastography. Management should emphasize optimization of glycemic control and reduction of abdominal obesity. Multicenter studies with longitudinal follow-up are needed to better assess the natural history of these patients and to refine screening and management strategies.

VI. REFERENCES

1. Younossi ZM, Golabi P, Paik JM, Henry A, Van Dongen C, Henry L. The global epidemiology of nonalcoholic fatty liver disease (NAFLD) and nonalcoholic steatohepatitis (NASH): a systematic review. Hepatology. avr 2023;77(4):1335-47.

2. Blais P, Husain N, Kramer JR, Kowalkowski M, El-Serag H, Kanwal F. Nonalcoholic fatty liver disease is underrecognized in the primary care setting. Am J Gastroenterol. 2015;110(1):10–4.
3. Rinella ME, Lazarus JV, Ratziu V, *et al.,* A multi-society Delphi consensus statement on new fatty liver disease nomenclature. J Hepatol 2023;79(6):1542–1556.
4. Loomba, R., Friedman, S. L. & Shulman, G. I. Mechanisms and disease consequences of nonalcoholic fatty liver disease. Cell 184, 2537–2564 (2021).
5. Sanyal, A. J. *et al.,*Prospective study of outcomes in adults with nonalcoholic fatty liver disease. N. Engl. J. Med. 385, 1559–1569 (2021).
6. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, *et al.,* IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. Diabetes Res Clin Pract. janv 2022;183:109119.
7. Younossi Z, Henry L. Contribution of Alcoholic and Nonalcoholic Fatty Liver Disease to the Burden of Liver-Related Morbidity and Mortality. Gastroenterology. Juin 2016;150(8):1778 85.
8. Castera L, Laouenan C, Vallet-Pichard A, Vidal-Trécan T, Manchon P, Paradis V, *et al.,* High Prevalence of NASH and Advanced Fibrosis in Type 2 Diabetes: A Prospective Study of 330 Out patients Undergoing Liver Biopsies for Elevated ALT, Using a Low Threshold. Diabetes Care. 1 juill 2023;46(7):1354 62.
9. Caussy C, Aubin A, Loomba R. The Relationship Between Type 2 Diabetes, NAFLD, and Cardiovascular Risk. Curr Diab Rep. 19 mars 2021;21(5):15.
10. Angulo P, Keach JC, Batts KP, Lindor KD. Independent predictors of liver fibrosis in patients with nonalcoholic steatohepatitis. Hepatol Baltim Md. déc 1999;30(6):1356 62.
11. Benjelloun S. Nutrition transition in Morocco. Public Health Nutr. févr 2002;5(1a):135 40.
12. Tada T, Toyoda H, Sone Y, Yasuda S, Miyake N, Kumada T, *et al.,* Type 2 diabetes mellitus: A risk factor for progression of liver fibrosis in middle-aged patients with non-alcoholic fatty liver disease. J Gastroenterol Hepatol. 2019 Nov;34(11):2011–2018. doi:10.1111/jgh.14696.
13. Younossi, Z.; Gramlich, T.; Matteoni, C.; Boparai, N.; Mccullough, A. Stéatose hépatique non alcoolique chez les patients atteints de diabète de type 2.Clin. Gastroenterol. Hepatol.2004,2, 262–265. DOI: 10.1016/S1542-3565(04)00014-X External Link.
14. Jérome, B.; Paul, C. Paramètre d'atténuation contrôlé (CAP) : un nouveau dispositif pour une évaluation rapide de la graisse hépatique ? Foie Int.2012,32, 875–877.
15. Wong, V.; Chan, W.; Chitturi, SYC Groupe de travail Asie-Pacifique sur les lignes directrices 2017 sur la stéatose hépatique non alcoolique - Partie 1 : Définition, facteurs de risque et évaluation.J. Gastroenterol. Hepatol.2018,33, 70–85. https://doi.org/10.1111/jgh.13857.
16. Targher G, Bertolini L, Padovani R, Rodella S, Tessari R, Zenari L, *et al.,*Prevalence of nonalcoholic fatty liver disease and its association with cardiovascular disease among type 2 diabetic patients. Diabetes Care. 2007 May;30(5):1212–1218. doi:10.2337/dc06-2247.
17. Williamson RM, Price JF, Glancy S, Perry E, Nee LD, Hayes PC, *et al.,* Prevalence of and risk factors for hepatic steatosis and nonalcoholic fatty liver disease in people with type 2 diabetes: the Edinburgh Type 2 Diabetes Study. Diabetes Care. 2011 May;34(5):1139–1144. doi:10.2337/dc10-2229.
18. Dvorak K, Stritesky J, Dvorakova M, Petrtyl J, Petrtylova K, Kroupa R, *et al.,* Nonalcoholic fatty liver disease in patients with type 2 diabetes mellitus: a prospective study. Eur J Gastroenterol Hepatol. 2007;19(10):879–887. doi:10.1097/MEG.0b013e3282e9d9a3.
19. Sporea F, Popescu A, Stoica V, Ionescu R, Ionescu-Tirgoviste C. Prevalence and risk factors of nonalcoholic fatty liver disease in patients with type 2 diabetes mellitus. Rom J Intern Med. 2011;49(1):49–55.
20. Jacqueminet S, Lebray P, Morra R, *et al.,* Dépistage de la fibrose hépatique à l'aide d'un biomarqueur non invasif chez les patients diabétiques. Clin Gastroenterol Hepatol 2008;6:828–31.
21. Kwok R, Choi KC, Wong GL, Zhang Y, Chan HL, Luk AO, *et al.,* Screening diabetic patients for non-alcoholic fatty liver disease with transient elastography: a prospective cohort study. Gut. 2016;65(8):1359–1368. doi:10.1136/gutjnl-2015-310265.
22. Ciardullo S, Monti T, Perseghin G. Prevalence of advanced liver fibrosis in patients with type 2 diabetes mellitus using non-invasive scoring systems: A population-based study. Diabetes Metab Syndr. 2020;14(6):1871–1876. doi:10.1016/j.dsx.2020.09.004.
23. Mikolasevic I, Milic S, Orlic L, Franjic N, Hauser G, Stimac D, *et al.,* Transient elastography (FibroScan®) with controlled attenuation parameter in the assessment of liver steatosis and fibrosis in patients with type 2 diabetes. World J Gastroenterol. 2016;22(4):1039–1047. doi:10.3748/wjg.v22.i4.1039.
24. Viganò M, Massironi S, Lampertico P, Fraquelli M. Screening for liver fibrosis in patients with type 2 diabetes using transient elastography: a multicenter study. J Hepatol. 2020;72(3):493–500. doi:10.1016/j.jhep.2019.10.030.
25. Jordan J, *et al.,* Prevalence of advanced liver fibrosis in patients with type 2 diabetes: a cross-sectional study using transient elastography. Diabetes Care. 2021;44(2):e27–e28. doi:10.2337/dc20-2321.

26. Sporea I, Mare R, Popescu A, Nistorescu S, Baldea V, Sirli R, *et al.,* Screening for liver fibrosis and steatosis in a large cohort of patients with type 2 diabetes using vibration controlled transient elastography and controlled attenuation parameter in a single-center real-life experience. J Clin Med. 2020;9(4):1032. doi:10.3390/jcm9041032.
27. Graupera I, Thiele M, Serra-Burriel M, Caballeria L, de Knegt RJ, Wai-Sun Wong V, *et al.,* Low screening rates despite a high prevalence of significant liver fibrosis in people with diabetes from primary and secondary care. J Hepatol. 2021;75(6):1232–1241. doi:10.1016/j.jhep.2021.07.013.
28. Béland-Bonenfant S, Petit JM, Vergès B. NAFLD et NASH au cours du diabète : données épidémiologiques, cliniques et pronostiques. Médecine Mal Métaboliques. 1 mai 2023;17(3):248 52.
29. Lonardo A, Nascimbeni F, Ballestri S, Fairweather D, Win S, Than TA, *et al.,* Sex Differences in Nonalcoholic Fatty Liver Disease: State of the Art and Identification of Research Gaps. Hepatol Baltim Md. oct 2019;70(4):1457 69.
30. Jessica K Dyson, Quentin M Anstee, Stuart McPherson. Non-alcoholic fatty liver disease: a practical approach to diagnosis and staging. Frontline Gastroenterol. 2014 Jul;5(3):211-218. https://doi.org/10.1136/flgastro-2013-100403 .
31. Bril F, Cusi K. Management of Nonalcoholic Fatty Liver Disease in Patients With Type 2 Diabetes: A Call to Action. Diabetes Care. mars 2017;40(3):419 30.
32. STEPHEN P. CASEY, WILLIAM W. KEMP, CATRIONA A. MCLEAN, DUNCAN J. TOPLISS, LÉON A. ADAMS & STUART K. ROBERTS. A prospective evaluation of the role of transient elastography for the detection of hepatic fibrosis in type 2 diabetes without overt liver disease. Scandinavian Journal of Gastroenterology. 2012; 47: 836–841. https://doi.org/10.3109/00365521.2012.677955.
33. Tacke F, Horn P, Wai-Sun Wong V, Ratziu V, Bugianesi E, Francque S, *et al.,* EASL–EASD–EASO Clinical Practice Guidelines on the management of metabolic dysfunction-associated steatotic liver disease (MASLD). Journal of Hepatology. juin 2024;S0168827824003295.
34. Tran Thi Khanh Tuong, Dang Khoa Tran, Pham Quang Thien Phu, Tong Nguyen Diem Hong, Thien Chu Dinh, et Dinh Toi Chu. Non-Alcoholic Fatty Liver Disease in Patients with Type 2 Diabetes: Evaluation of Hepatic Fibrosis and Steatosis Using Fibroscan. Diagnostics 2020, 10, 159. 10.3390/diagnostics10030159
35. Tagkou NM, Goossens N. Stéatose hépatique non alcoolique : diagnostic et traitement en 2022. Schweiz Gastroenterol. 2023;4(1):27 37.
36. Isabel Graupera, Maja Thiele, Miquel Serra-Burriel, Llorenç Caballeria, Dominique Roulot, Grace Lai-Hung Wong. Low Accuracy of FIB-4 and NAFLD Fibrosis Scores for Screening for Liver Fibrosis in the Population. Clinical Gastroenterology and Hepatology 2022;20:2567–2576.
37. Hirsh D. Trivedi, Jaspreet Suri, Daheun Oh, Jeffrey Schwartz, Daniela Goyes, Rajab Idriss *et al.,* The presence of diabetes impacts liver fibrosis and steatosis by transient elastography in a primary care population. Annals of Hepatology. Volume 24, September–October 2021, 100336. https://doi.org/10.1016/j.aohep.2021.100336
38. Z. Bouabane, A. Zazour, G. Kharrasse, W. Khannoussi, Z. Ismaili. La stéatose hépatique non alcoolique chez les diabétiques de type 2. J. Mar Endocrinol Diabétol / N° 8 - Février 2020. Service d'hépato-gastroentérologie, CHU Mohammed VI d'Oujda.
39. Mauro Viganò, Nicola Pugliese, Federica Cerini, Federica Turati, Vincenzo Cimino, Sofia Ridolfo, Simone Rocchetto *et al.,* Accuracy of FIB-4 to Detect Elevated Liver Stiffness Measurements in Patients with Non-Alcoholic Fatty Liver Disease: A Cross-Sectional Study in Referral Centers. Int J Mol Sci. 2022 Oct 18;23(20):12489.
40. Ryan, C.; Johnson, L.; Germin, B.; Marcos, A. Cent biopsies hépatiques consécutives dans le cadre du bilan des donneurs vivants pour une transplantation hépatique du lobe droit. Greffe du foie.2002,8, 1114–1122. DOI: 10.1053/jlts.2002.36740