Feasibility of using portal vein pulsatility index PVPI for risk stratification in patients with non-alcoholic fatty liver disease NAFLD.

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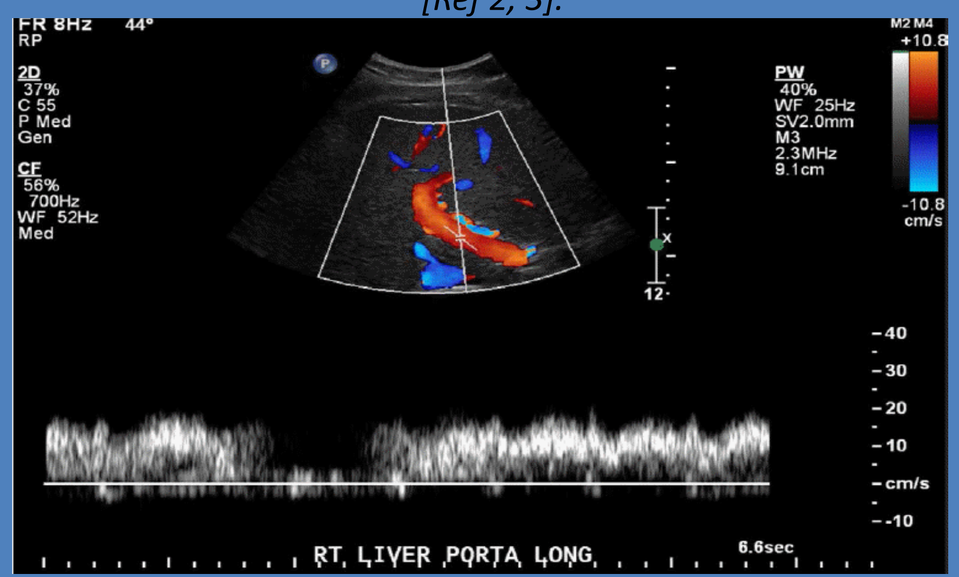
Background:

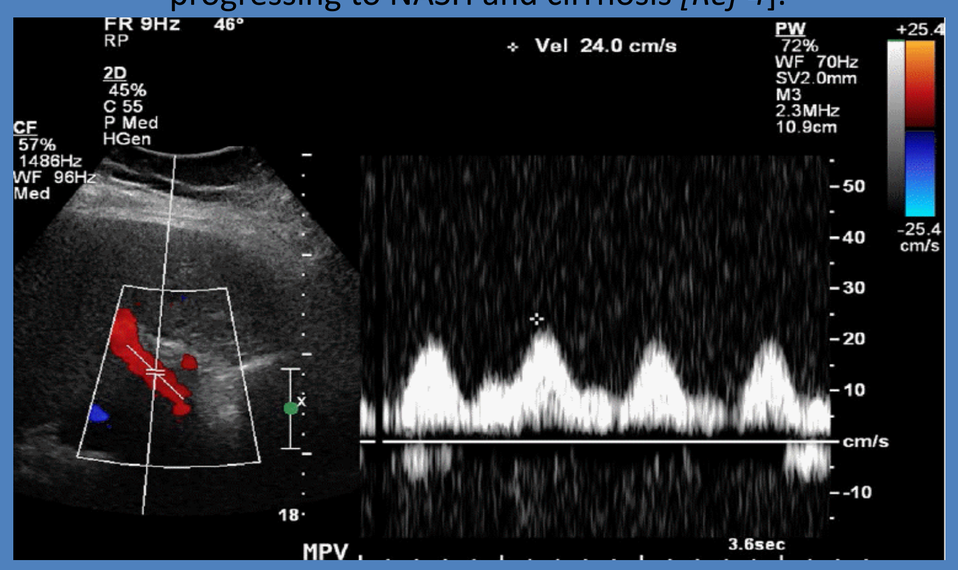
Non-alcoholic steatosis is the most common cause of abnormal liver function tests (LFTs). With rising levels of obesity, up to 30% of the general population are estimated to have steatosis. Prognosis depends on liver fibrosis rather than actual fat. Predicting which individuals will progress to steatohepatitis (NASH) and cirrhosis, with the inherent risk of developing hepatocellular carcinoma (HCC), is of importance. The most definitive measure for diagnosing NASH and cirrhosis is a liver biopsy. Non-invasive methods to select individuals to undergo liver biopsy are in use, such as elastography, which measures liver stiffness (e.g. Fibroscan) , and laboratory indices *[Ref 1*].

Ultrasound (US) is the first line imaging to investigate abnormal LFTs. Blood flow in the portal vein (PV) can be relatively easily examined during liver US *[Ref 2, 3].*



Normal portal vein flow (PVF) is in hepatopetal direction (towards liver=red), with gentle waveform undulations and peak systolic velocity between 16-40 cm/s. Cursor aligned with PV, colour and velocity scale correctly set *[Ref 5].*

It has been postulated that the increased PV pulsatility (see example below) may be a sensitive parameter in identifying patients with high risk of progressing to NASH and cirrhosis *[Ref 4*].



Portal vein pulsatility index (PVPI) is the difference between peak systolic velocity and end diastolic velocity, divided by peak systolic velocity (24 - 9/24=0.625) *[Ref 5].*

Aim:

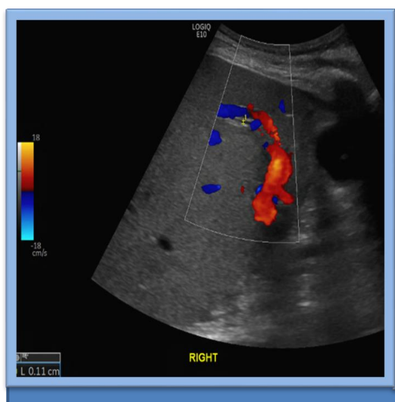
To establish feasibility of stratifying risk of progression of non-alcoholic fatty liver disease (NAFLD) to steatohepatitis (NASH)/cirrhosis by non-invasive means of calculating portal vein pulsatility index (PVPI).

Methods:

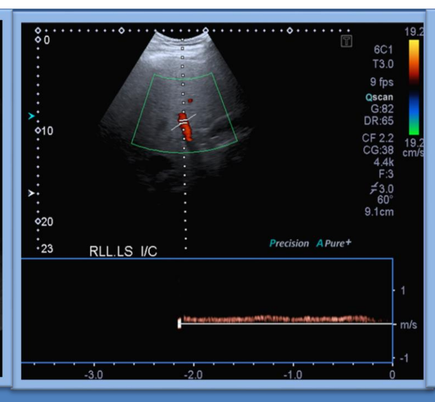
We have retrospectively reviewed portal vein flow (PVF) and calculated portal vein pulsatility index (PVPI) in a cohort of 62 patients referred for Fibroscan with either clinically or biopsy confirmed diagnosis of NAFLD, and compared it to the Fibroscan grading of fibrosis and liver biopsy, where available.

Results:

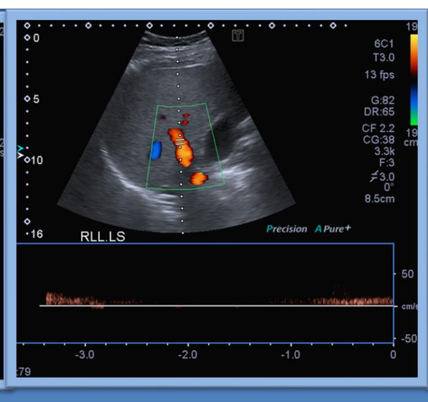
1. Of the 62 patients, only 28 patients who underwent US had adequately documented colour and spectral Doppler PV assessment. There were technical shortcomings even of the documented PVF: lack of optimisation of the Doppler angle, or colour and spectral velocity scales; inadequate length of trace; no recorded measurement of flow velocity; sampling of hepatic arterial flow instead of PVF; unsuitable segment of PV used for obtaining the waveform.



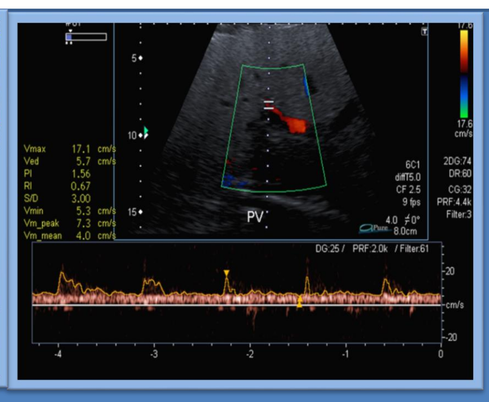
No spectral waveform obtained to allow velocity measurement.



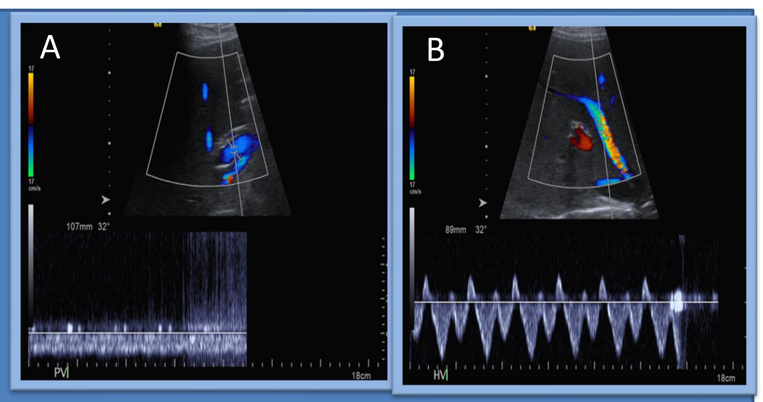
Direction of cursor not aligned with PV.
Velocity scale set high (in m/s instead in cm/s).



Midportion of waveform not displayed.



Gate is placed in hepatic artery (HA) adjacent to PV, which is also visible (to the right of the gate, with its flow superimposed).
Automated velocity measurement is a mixture of HA (Vmax) and PV (Ved).



PV waveform displayed on image A Indicates reversed flow (blue) , the same as hepatic vein (HV). Image B from the same study shows PVF is in fact hepatopetal (red), visible to the left of HV (blue),with HV waveform recorded).

2. The value of 0.48 +/- 0.31 was considered normal PVPI in accordance with literature; just one patient in our cohort had increased PVPI. We found no correlation with Fibroscan grading of fibrosis. Of the 7 patients who had liver biopsy, 3 had no adequate PVF assessment, in the remaining 4 patients there was mild/moderate fibrosis on biopsy, which corresponded to a normal PVPI.
A teaching session has been scheduled for US staff on the significance and correct technique of PVF assessment, and we hope to prospectively measure PVPI in a new cohort of NAFLD patients, applying the correct US technique.

Conclusions: PVPI has been reported to have the potential to become a useful prognostic index for patients with NAFLD. We found inadequate documentation of PVF preventing accurate PVPI measurement in our cohort of patients. We are planning a prospective PVPI comparison with Fibroscan after a teaching session on the correct PVF technique.

References:
1. Non-alcoholic fatty liver disease: a practical approach to treatment. Dyson JK, et al. Frontline Gastroenterology 2014;5:277-286.
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3. Doppler sonography of portal hypertension. Robinson KA,et al. Ultrasound Quarterly 2009;25:3-13.
4. M Baikpour – personal communication (2019).
5. Altered Doppler flow patterns in cirrhosis patients: an overview. Iranpour P,et al. Ultrasonography 2016;35:3-12.

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