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Introduction

- Relationship between plaque morphology, cerebral micro-embolic signals (MES) and platelet biomarkers in carotid stenosis remains unclear

Aims

- ? Differences in Plaque Morphology on Colour Doppler Ultrasound (CDUS) in Recently Symptomatic vs. Asymptomatic 50-99% Carotid Stenosis patients
- ? Plaque echodensity on CDUS influences markers of Platelet production / Activation or Turnover

Methods

- Data combined from 2 prospective, longitudinal observational, analytical studies (PACS & HEIST)
- Assessed Plaque morphology, MES data and Platelet Biomarkers in:

- Recently Symptomatic 50-99% Carotid Stenosis (≤4/52 after TIA / Ischaemic Stroke (N = 42) vs. - Asymptomatic 50-99% Carotid Stenosis Patients (N = 36)

- Plaque morphology on Doppler ultrasound graded with Gray-Scale Median (GSM) scoring [Fig. 1]:
- Echolucent plaques = GSM ≤ 25
- Echodense Plaques = GSM > 25
- 1-hour bilateral simultaneous Transcranial Doppler Ultrasound (TCD) of MCAs to classify MES status: MES+ve or MES-ve [Fig. 2]
- FBC analysis: Plt count + MPV
- Whole Blood Flow Cytometry: % Platelet CD62P & CD63 expression, % Leucocyte-Platelet Complexes and Reticulated Platelets

Results

Table 1: GSM & MES in Recently Symptomatic vs. Asymptomatic Patients: Medians [25th – 75th percentiles] or %s (absolute values)

Characteristic	Recently symptomatic (N = 42)	Asymptomatic (N=36)	P Value
GSM whole cohort	25 [13 – 36]	30 [14 – 43]	0.31
GSM moderate stenosis	18 [13 – 49.5]	37.5 [17.5 – 57.8]	0.27
GSM severe stenosis	29 [13 – 35]	22 [10.5 – 40.75]	0.797
GSM ≤ 25 (Echolucent)	21 (50%)	15 (41.66%)	0.50
Ipsilateral MES % (N)	16.7% (7)	0% (0)	0.013
GSM MES +VE	36 [19 – 58]	N/A	N/A
GSM MES -VE	25 [13 – 35.5]	30 [14 – 43]	0.39

Fig. 1: GSM scoring of plaques on B Mode images from CDUS

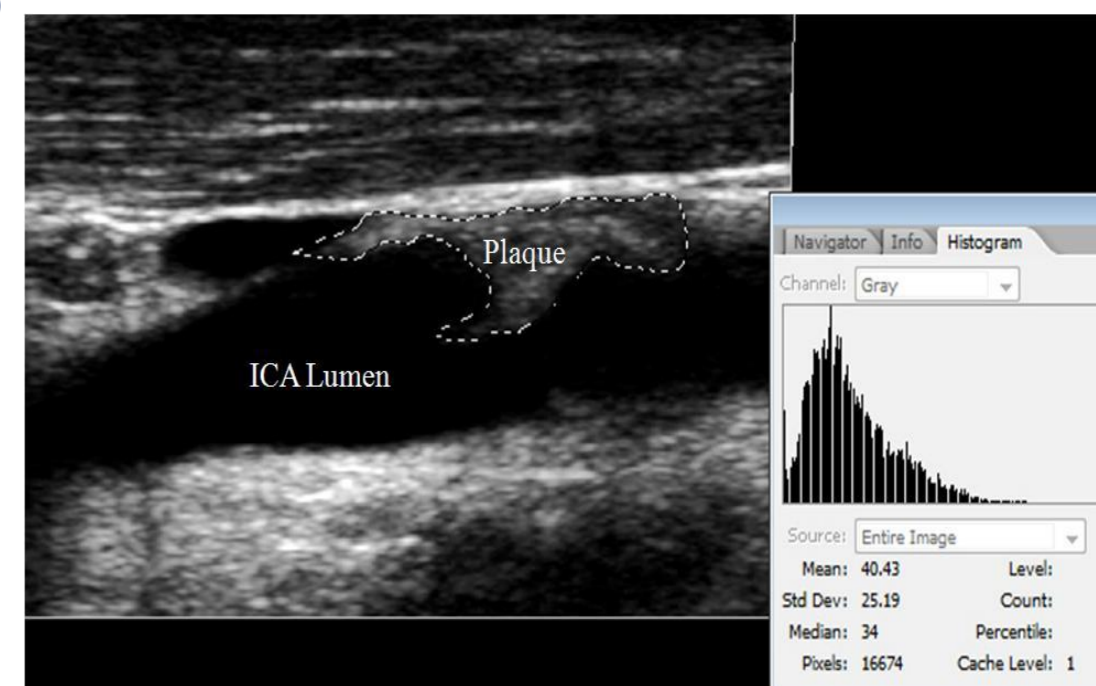


Fig. 2: TCD tracing: HITS = Micro-embolus in the MCA (Arrow)

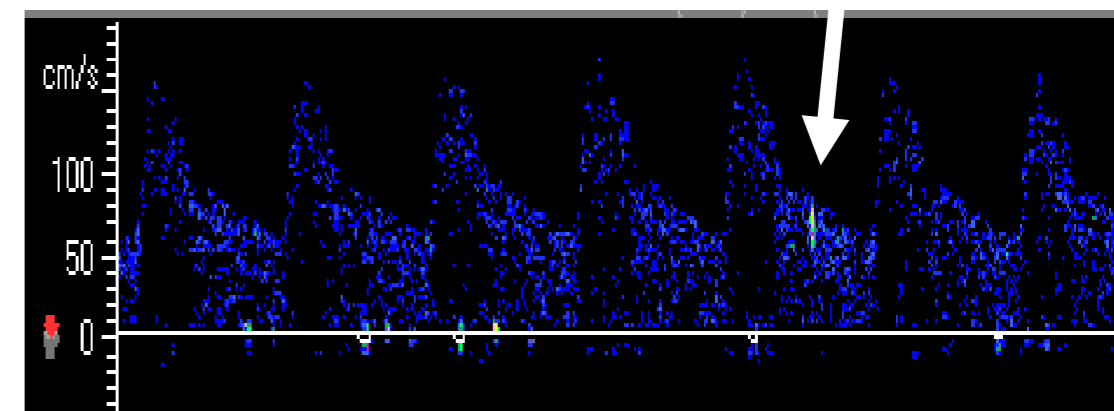


Table 2: Comparison of Platelet Biomarkers between patients with Echolucent (GSM ≤ 25) & Echodense (GSM > 25) plaques within groups and between Symptomatic vs. Asymptomatic GSM subgroups: Values are Medians [25th-75th percentiles]

Biomarker	Recently Symptomatic GSM ≤ 25 (N = 21)	Recently Symptomatic GSM > 25 (N = 21)	P	Asymptomatic GSM ≤ 25 (N = 15)	Asymptomatic GSM > 25 (N = 21)	P	Recently Symptomatic vs. Asymptomatic GSM ≤ 25 P	Recently Symptomatic vs. Asymptomatic GSM > 25 P
Platelet Count (Citrate x10 ⁹ /L)	201 [187 – 259]	228 [195 – 277]	0.39	184 [146 – 214]	191 [163 – 224]	0.66	0.06	0.02
Mean Platelet Volume (Citrate; fl)	9.9 [9.25 – 10.4]	10 [9.2 – 10.5]	0.92	9.8 [9.2 – 10.8]	9.6 [9.3 – 9.8]	0.32	0.69	0.32
% CD62P	1.92 [1.48 – 2.83]	2.2 [1.16 – 2.2]	0.85	2.12 [0.87 – 2.94]	2.18 [1.28 – 3.09]	0.35	0.44	0.87
% CD63	11.3 [7.86 – 15.3]	9.12 [5.15 – 15]	0.40	9.35 [6.89 – 11.9]	10.5 [6.8 – 15.15]	0.66	0.29	0.61
% Neutrophil-Platelet Complexes	2.53 [2.23 – 3.64]	3.3 [2.74 – 4.43]	0.04	2.75 [2.3 – 3.11]	2.7 [2.3 – 3.35]	0.95	0.63	0.032
% Monocyte-Platelet Complexes	5.2 [4.02 – 6.92]	6.3 [4.9 – 7.8]	0.23	4.85 [4.05 – 5.5]	4.55 [3.8 – 5.4]	0.69	0.45	0.02
% Lymphocyte-Platelet Complexes	2.58 [2.12 – 2.93]	2.91 [2.72 – 3.32]	0.014	2.36 [1.75 – 2.65]	2.53 [1.89 – 2.71]	0.80	0.26	0.001
Reticulated platelets (%)	11.9 [8.1 – 22.4]	15.1 [8.9 – 19.5]	0.90	13.9 [7.2 – 25.8]	13.9 [9.2 – 20.6]	0.78	0.90	0.80

Discussion

- Consistent with prior data, MES more common in Recently Symptomatic vs. Asymptomatic moderate-severe carotid stenosis [Table 1]
- No differences in plaque echolucency between:
 - Symptomatic vs. Asymptomatic patients or
 - Recently Symptomatic MES+ve vs. MES-ve patients
- Recently Symptomatic patients with 'GSM-echodense plaques' had enhanced platelet production/secretion (higher platelet counts) and platelet activation (leucocyte-platelet complexes) vs. Asymptomatic GSM-echodense patients [Table 2]
- Simultaneous assessment with neurovascular-imaging & platelet biomarkers enhances our understanding of the pathogenesis of symptoms and may aid risk-stratification and clinical decision making in carotid stenosis patients

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