Sex differences in optimal medical therapy following invasive angiography for coronary artery disease

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Introduction & Purpose

- Coronary artery disease (CAD) remains the number one cause of death in women worldwide despite advances in treatment (1).
- Women who experience myocardial infarction (MI) and undergo invasive angiography experience higher morbidity and mortality compared to males.
- Local data has suggested this difference may be predominantly in women >55 (2).
- The prognostic benefit of optimal medical therapy (OMT) (see figure 1) is well established; however, data suggests women are less likely to receive this compared to men (3,4).
- Here we aimed to establish whether there were sex differences in OMT received following invasive angiography for obstructive CAD at Barts Heart Centre.

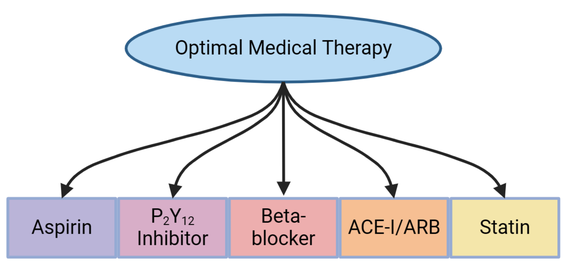

Figure 1. Optimal medical therapy for secondary prevention following ACS according to international guidelines (5). NB for stable angina, medical management will vary depending on the degree of coronary stenosis and whether revascularisation is undertaken. ACE-I – angiotensin converting enzyme inhibitor. ARB – angiotensin receptor blocker. P2Y12 inhibitor – high potency antiplatelets. Image created with Biorender.com.

Methods

- Single centre retrospective study examining OMT received by females and males with obstructive CAD undergoing invasive angiography in 2017, 2019 and 2022.
- Discharge medications extracted from electronic patient record and entered into a database.
- Categorical data were compared using chi-squared or fisher exact test. Students t-test and Mann-Whitney U test were used to compare normally and non-normally distributed continuous data respectively.
- Pooled analysis of sex differences and sub-group analysis according to diagnosis (Acute coronary syndrome [ACS], ST-elevation MI [STEMI], Non-ST-Elevation MI [NSTEMI], stable angina) and age (≤ 55 years or >55 years i.e. post-menopausal) performed.
- Multivariate binomial logistic regression used to adjust for confounder including age, BMI, diabetes, hypertension, hypercholesterolaemia, previous MI and previous percutaneous coronary intervention.
- A ROC curve and calculation of AUC was used to evaluate the regression models.
- Statistical analysis was carried out using R studio 2023.12.0+369 and GraphPad Prism 10.1.0
- Ethical permissions obtained under EDGE ID: 142567

Demographics

	All	Female	Male	P value
Patients	7239	1671 (23.0%)	5568 (77.0%)	
Age	62.48 (+/-12.30)	66.30 (+/-12.12)	61.33 (+/-12.13)	<0.001
BMI	27.95 (6.08+/-)	28.04 (+/-5.76)	27.92 (+/-6.17)	0.509
Ethnicity				
Asian	2726 (37.7%)	546 (32.7%)	2180 (39.2%)	<0.001
Black	389 (5.4%)	153 (9.2%)	236 (4.3%)	<0.001
Caucasian	3915 (54.3%)	927 (55.7%)	2988 (53.8%)	0.191
Other	159 (2.2%)	36 (2.2%)	123 (2.2%)	0.973
Unknown	24 (0.3%)	2 (0.1%)	22 (0.4%)	0.141
Co-morbidities				
Hypertension	4069 (56.2%)	1050 (62.8%)	3019 (54.2%)	<0.001
Hypercholesterolaemia	4118 (56.9%)	967 (57.9%)	3151 (56.6%)	0.651
Diabetes	2562 (35.9%)	695 (41.8%)	1867 (34.1%)	<0.001
Previous MI	1578 (21.8%)	270 (16.2%)	1308 (23.5%)	<0.001
Previous PCI	1671 (23.1%)	294 (17.6%)	1377 (24.7%)	<0.001
Previous CABG	569 (7.9%)	91 (5.4%)	478 (8.6%)	<0.001

Table 1. Demographics of study cohort. Females were older, with a higher proportion of black patients and a lower proportion of Asian patients. There was a higher incidence of hypertension and diabetes in the female group, and a lower incidence of previous MI, previous PCI and previous CABG.

Pooled Analysis

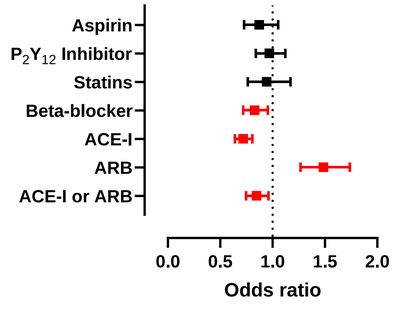

Figure 2. Pooled multivariate logistic regression analysis of all CAD patients. Females significantly less likely to receive beta-blocker (OR=0.83, p=0.009) and ACE-I (OR=0.72, p<0.001) but more likely to receive ARB (OR=1.49, p<0.001). Females were less likely to receive combined ACE-I or ARB therapy (OR=0.85, p=0.010).

Sub-group Analysis

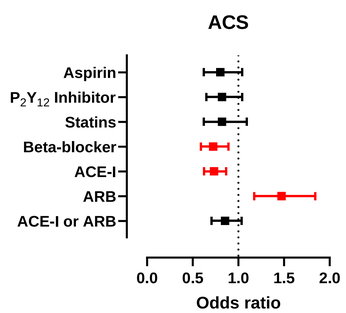

Figure 3. Females with an ACS were less likely to receive beta-blockers (OR=0.73, p=0.002), ACE-I (OR=0.73, p=<0.001) but more likely to receive and ARB compared to males (OR=1.47, p<0.001) (n=4397, female=991).

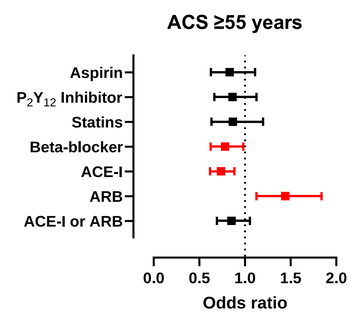

Figure 4. Females with ACS ≥55 years were less likely to receive beta-blockers (OR=0.78, p=0.034) and ACE-I compared to males (OR=0.74, p<0.001) (n=3012, female=798).

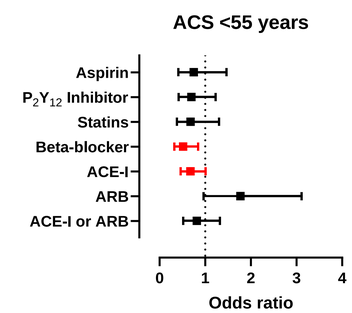

Figure 5. Females with ACS <55 years were less likely to receive beta-blockers (OR=0.52, p=0.006) and ACE-I (OR=0.68, p=0.048) compared to males (n=1375, females=191).

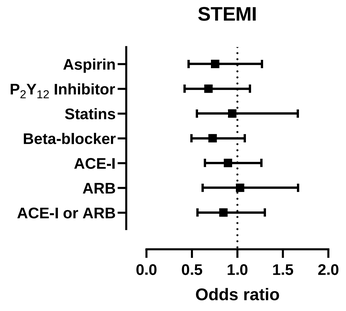

Figure 6. There were no differences in discharge medications between males and females in the STEMI group (n=1704, female=334).

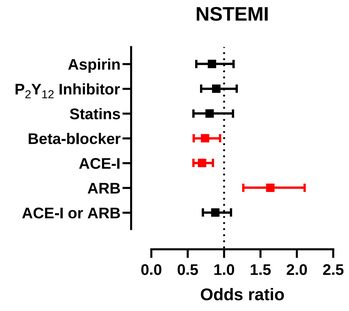

Figure 7. Females with NSTEMI were less likely to receive beta blockers (OR=0.74, p=0.015) and ACE-I (OR=0.70, p=<0.001) compared to males (OR=0.61, p=0.003) (n=2694, female=657).

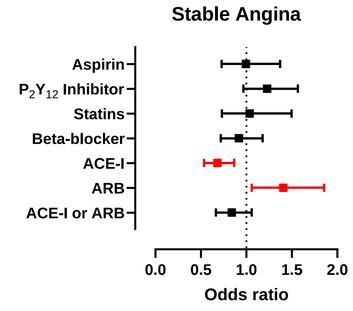

Figure 8. Females with stable angina were less likely to receive an ACE-I (OR=0.68, p=0.002) but more likely to receive and ARB (OR=1.41, p=0.02) (n=1761, female=426).

Time Trend Analysis

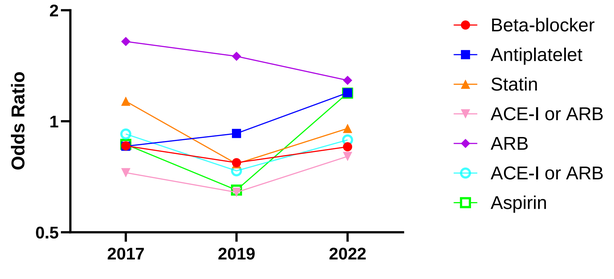

Figure 9. Multivariate logistic regression odds ratios by year. Whilst raw odds ratios suggested differences in prescribing over time, possibly with a trend towards improvement by 2022, there were no statistically significant interactions between sex and time.

Conclusions

- **Women undergoing invasive angiography for obstructive CAD appeared to receive less OMT drugs on discharge compared to males in particular beta-blockers and ACE-I/ARBs.**
- **These differences were driven predominantly by reduced prescriptions in women with ACS, in particular NSTEMI but also in stable angina (Fig 3, 8 and 8).**
- **Differences were evident in both women ≥55 and <55 years (Fig 4 and 5).**
- **Our data suggests that worse outcomes for women may be due in part to sub-optimal use of medications post-PCI.**
- **Future work will be directed at understanding why differences occurred and mechanistic consequences in OMT pharmacology between females and males.**
- **This work highlights a potential need for sex-based guidance on optimal medical therapy in ACS.**

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Andrew Sullivan and this work is funded by the Health Advances in Underrepresented Populations and Diseases (HARP) Wellcome Trust PhD Fellowship

Declarations of Interest: None