Aortic intramural haematoma: natural history and predictive factors for complications
C A Nienaber, B M Richartz, T Rehders, H Ince, M Petzsch


Intramural haematoma (IMH) of the aorta is attracting growing interest as a variant of aortic dissection and is more frequently diagnosed by modern tomographic imaging modalities in the evaluation of acute aortic syndromes.\(^1\)\(^,\)\(^2\) The evolution from IMH to overt dissection or early rupture may occur suddenly or is heralded by ongoing acute aortic (pain) syndrome. Unlike classic aortic dissection, IMH has no mechanisms of decompression by a re-entry tear but rather reveals intramural (intramedial) thickening or echolucent pockets of non-communicating blood with potential for rupture or, at times, regression and resorption of haematoma with time.\(^3\)\(^,\)\(^4\) As in overt dissection, widening of the mediastinum or the aortic shadow, pleural effusion and pain, aortic regurgitation, and peri-aortic (pain) syndrome are incidental.\(^5\) Hence, the subtle initial pathology of IMH is more likely to be missed than overt dissection, especially in the absence of recurrent pain ("aortic syndrome"). While diagnostic and therapeutic implications of IMH continue to impact on vascular medicine, description of natural course and prediction of individual risk is far from settled.\(^6\)\(^–\)\(^10\)

**PREDICTORS OF EARLY PROGRESSION AND DEATH**

Observational data from independent groups revealed evidence that the IMH evolves to resorption or progression to either classic dissection, contained rupture or formation of an aneurysm within 30 days of hospital admission.

Proximal location of IMH is clearly considered an independent predictor of progression to dissection, contained rupture, or aneurysm formation. In our series of 66 cases of IMH (38 type A and 28 type B), 73% of progressive IMH were of type A compared to 44% in stable IMH (odds ratio (OR) 4.3, 95% confidence interval (CI) 1.5 to 12.3; \(p = 0.02\)). Early progression was unrelated to age, sex, chronic arterial hypertension, Marfan syndrome, aortic regurgitation, and peri-aortic (pain) syndrome were incidental.\(^7\) Hence, the subtle initial pathology of IMH is more likely to be missed than overt dissection, especially in the absence of recurrent pain ("aortic syndrome"). While diagnostic and therapeutic implications of IMH continue to impact on vascular medicine, description of natural course and prediction of individual risk is far from settled.\(^8\)\(^–\)\(^10\)

**PREDICTORS OF LATE PROGRESSION**

Late progression of IMH was associated with younger age (49 (17) years v 64 (11) years in IMH without late progression; \(p < 0.003\)). Marfan syndrome (\(p = 0.02\)), and absence of \(\beta\) adrenergic antagonists (only 7% of IMH with late progression were treated with \(\beta\) blockers compared to 49% of IMH patients without late progression; \(p = 0.009\)). On multivariate analysis only younger age (OR 0.92, 95% CI 0.86 to 0.98; \(p = 0.01\)) and absence of long term oral \(\beta\) blocker treatment (OR 10.8, 95% CI 1.2 to 96.4; \(p = 0.03\)) were confirmed as independent predictors of late progression (table 1, fig 2); Marfan syndrome failed to qualify as a risk predictor on multivariate analysis (\(p = 0.5\)).

Actuarial survival analysis of IMH confirmed better long term outcome on oral \(\beta\) blocker treatment (93% v 67% in patients without \(\beta\) blocker treatment (\(p = 0.004\)). \(\beta\) Adrenergic blocking agents are effective in managing classic aortic dissection and in retarding progression of aortic root

![Figure 1](http://www.heartjnl.com)
Aneurysm in both Marfan syndrome and abdominal aneurysm. β Blockers protect by reducing wall stress, systolic arterial pressure, and the rate of pressure changes and, presumably, by stabilising the extracellular vascular matrix of the aorta.15 Thus, our finding that effective β blocker treatment infers a reduced rate of late progression is novel,10 but not unexpected in IMH considering the beneficial impact of vigorously lowering the driving force for dissection.

The observation that older age (> 55 years) at initial diagnosis of IMH has a better long term prognosis may be explained by more focal microcars along the aortic wall inherently limiting the longitudinal progression of IMH.14 Accordingly, favourable outcomes of IMH are consistently reported in patients beyond 65 years.8-11 Thus, considering both advanced aortosclerosis with older age and the lower risk of progression, a conservative strategy (with β blockade and serial imaging) may be justified in elderly multimorbid patients and in distal IMH.10

**INTRAMURAL HAEMATOMA AND PENETRATING AORTIC ULCERS**

Ulcer-like projections in aortic segments of IMH identify a subset of patients at high risk. Penetrating atherosclerotic ulcers (PAU) are known to result from progressive erosion of atheromatose mural plaque penetrating the elastic lamina, finally separating media layers and setting the stage for adjacent intramural haematoma with either local or longitudinal progression. PAUs are preferentially (> 90%) observed in IMH of the descending aorta, while IMH without PAU is more frequently present in the ascending aorta.

Symptomatic PAU infers complications such as formation of aneurysm, pseudoaneurysm, and dissection, or unpredictable rupture. Careful imaging is vital to identify both diameter and depth of ulcers with IMH, since width > 2 cm and depth > 1 cm may herald the need for interventional or surgical repair to avoid rupture and death.10

**Table 1** Multivariate analysis of predictors of progression

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early progression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type A IMH</td>
<td>3.89</td>
<td>1.30 to 11.61</td>
<td>0.02</td>
</tr>
<tr>
<td>Aortic diameter (mm)</td>
<td>0.96</td>
<td>0.92 to 0.997</td>
<td>0.03</td>
</tr>
<tr>
<td>Late progression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absence of long term β blocker treatment</td>
<td>10.8</td>
<td>1.2 to 96.4</td>
<td>0.03</td>
</tr>
<tr>
<td>Age &lt; 55 years</td>
<td>0.92</td>
<td>0.86 to 0.98</td>
<td>0.01</td>
</tr>
</tbody>
</table>

CI, confidence interval; IMH, intramural haematoma; OR, odds ratio. Marfan syndrome was not significant on multivariate analysis (p = 0.5) and was thus not entered into the final model.

**Table 2** Predictors of IMH progression

<table>
<thead>
<tr>
<th>Feature</th>
<th>p Value</th>
<th>Risk for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progressive aortic wall thickness</td>
<td>0.011</td>
<td>Full dissection</td>
</tr>
<tr>
<td>Local aortic diameter (&gt;56 mm)</td>
<td>&gt;0.17</td>
<td>Full dissection</td>
</tr>
<tr>
<td>Large PAU on top of IMH</td>
<td>&gt;0.004</td>
<td>Progressive erosion</td>
</tr>
<tr>
<td>Increasing pleural effusion</td>
<td>&gt;0.0003</td>
<td>Progressive erosion</td>
</tr>
<tr>
<td>Symptomatic PAU</td>
<td>&gt;0.0001</td>
<td>Progression in length</td>
</tr>
<tr>
<td>IMH of ascending aorta</td>
<td>0.02</td>
<td>Full dissection</td>
</tr>
<tr>
<td>Progressive aortic diameter</td>
<td>0.03</td>
<td>Dissection, rupture</td>
</tr>
<tr>
<td>No β blocker treatment</td>
<td>0.03</td>
<td>Late progression</td>
</tr>
<tr>
<td>Age &lt;55 years</td>
<td>0.01</td>
<td>Late progression</td>
</tr>
</tbody>
</table>

IMH, intramural haematoma; PAU, penetrating atherosclerotic ulcers.

**Figure 2** Contrast enhanced spiral computed tomography documenting the evolution of acute intramural haematoma of the descending aorta to open dissection with communication between the true and a false lumen: (A) baseline; (B), three months; (C) six months.

**SIGNS OF PROGRESSION IN INTRAMURAL HAEMATOMA**

Predictors of IMH progression are summarised in table 2. Persistent and recurrent pain despite aggressive medical
treatment, or repetitive pleural effusion, are important indicators of disease progression. While large PAU may be a common denominator of progression and adverse outcome, absence of PAU does not predict a stable course of IMH. A closer look reveals that 75% of proximal IMH patients died or had surgical replacement by the time of follow up. Conversely, IMH of the descending aorta may indeed warrant watchful waiting, supporting a previous notion. Moreover, a recent meta-analysis on morbidity and mortality of both IMH and ulcerations of the aorta offers additional insight. The natural course of 168 cases of typical IMH led to overt aortic dissection in 25% of ascending aortic IMH and in 13% of descending IMH, to aortic rupture in 28% and 9%, respectively, or to stabilisation in 28% and 76%, respectively; 30 day mortality was 18% with surgical repair of proximal IMH, and 33% with surgery to distal IMH compared to 60% and 8% with medical treatment of proximal and distal IMH, respectively.

IMH as “acute aortic syndrome” is indicative of a dynamic process and imminent events, and thus should focus our attention on diagnostic confirmation of progression with subsequent treatment by either surgical repair or interventional stent-graft placement.

CONCLUSIONS

IMH of the aorta is a potentially lethal disorder with frequent progression to aortic rupture, dissection or aneurysm. Short term prognosis is serious in IMH involving the ascending aorta, and surgical repair improves outcome regardless of the aortic diameter. IMH of the descending aorta, especially when confined to a short segment or with aortic diameters < 50 mm has a better outcome, but may not be excluded from early progression. Five year survival of IMH is < 50%; yet late progression is neither predicted by location of IMH or width of the aorta nor by presence of risk factors. Long term prognosis, however, may benefit from chronic effective β blockade regardless of surgical repair.

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REFERENCES

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