Article title: The scores in cardiology; the Syntax score

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The scores in Cardiology; Syntax score

Introduction:

The SYNTAX score is an angiographic grading tool to determine the complexity of coronary artery disease [(1)].The SYNTAX score was originally developed to characterize the coronary anatomy of patients with multivessel/complex coronary artery disease allocated to PCI (percutaneous coronary intervention) or coronary artery bypass graft (CABG) in the landmark SYNTAX trial (SYNergy between PCI with TAXUS™ and Cardiac Surgery) [(2)]

The score has been developed based on the following:
1. The AHA (American Heart Association)classification of the coronary tree segments modified forthe ARTS study[(3)].
2. The Leaman score
3. The ACC (American College of Cardiology)/AHA lesions classification system
4. The total occlusion classification system
5. The Duke and ICPS classification systems for bifurcation lesions
6. Consultation of experts

However, each of these classifications has been focusing on specific functionaland anatomical parameters of the lesions and a global classification system that takes into account all variables was necessary.

Main elements of the score

The main elements and definitions for the Syntax score can be summarized as follows:

- The coronary artery tree is divided into 16 segments as proposed by the AHA[(3)] and modified for ARTS I and II trials[(4)].
- Based on the (modified) Leaman score, each vessel or vessel segment is weighed according to degree of stenosis and

contribution to blood supply of the left ventricle. The contribution of each vessel to the left ventricle blood supply depends on the dominance ie the artery that gives origin to PDA (posterior descending artery).For example , the weighing factor (points given) for right coronary artery, left main stem, proximal left anterior descending artery and proximal left circumflex artery are 1/5/3.5/1.5 and 0/6/3.5/2.5 for right and left dominant systems respectively .

- Lesions are considered significant if they cause > 50% diameter stenosis by visual assessment. Significant lesions are subdivided into occlusive (100% diameter stenosis) and non-occlusive (50-99%) with a multiplication factor of 5 applied to occlusive lesions and 2 for non-occlusive disease. Lesions of < 50 % diameter stenosis and vessels of <1.5 mm in diameter or less are excluded.
- Multiple lesions occurring in tandem < 3 vessel reference diameter apart are considered as one lesion.
- Several elements of the AHA/ACC lesion classification namely length > 20 mm, severe tortuosity, heavy calcification and intraluminal thrombus are included in the score.
- Total occlusion is when no antegrade flow is visible distal to the obstruction. Segments distal to the occlusion may be filled by bridging, ipsilateral or contra-lateral collaterals.
- Aorto-ostial disease (disease immediately at origin from the aorta) is considered technically challenging and is included in the score. It applies for segments 1(proximal RCA) and 5 (Left main) or 6(proximal LAD) and 11(proximal LCX) in case of double ostium of left coronary artery
- Bifurcation stenosis is significant stenosis at the junction of a main vessel and a side branch of at least 1.5 mm in diameter.Bifurcations are only considered for the following segment junctions: 5/6/11, 6/7/9, 7/8/10, 11/13/12a, 13/14/14a and 3/4/16 and 13/14/15 in case of left dominance.For bifurcation lesions, one point is given for types A, B, and

Ccorresponding to Medina classification (1,0,0/0,1,0/1,1,0) two points are given for types D, E, F, and G (1,1,1,/0,0,1/1,0,1/0,1,1,); and one point is given for an angulation <70 degrees between main branch and side branch.

- Trifurcation is a junction of three branches, one main vessel and two side branches (with a minimal diameter of 1.5mm). In a trifurcation, one, two, three or four of the involved segments can be diseased.
- Many of the parameters of the ACC/AHA lesion classification system have been incorporated in the Syntax score. Tortuosity defined as one or more bends of 90° or more, or three or more bends of 45° to 90° proximal of the diseased segment, long lesion of > 20 mm in length, heavy calcification defined as multiple persisting opacifications of the coronary wall visible in more than one projection surrounding the complete lumen of the coronary artery at the site of the lesion and thrombus defined as spherical, ovoid or irregular intraluminal filling defect or lucency surrounded on three sides by contrast medium seen just distal or within the coronary stenosis in multiple projections or a visible embolization of intraluminal material downstream, are part of the score.
- Presence of diffuse disease/small vessel defined as at least 75% of the length of the segment distal to the lesion with a vessel diameter of <2mm, irrespective of the presence or absence of disease at that distal segment.

How to calculate the syntax score

The syntax score is calculated by answering 12 main questions. This can be performed by an online calculator available at www.syntaxscore.com. Table 1 summarizes the question algorithm for the Syntax score.

Utility of the Syntax score

Themain utility of the Syntax score is to predict outcomes in patients with complex coronary artery disease undergoing revascularization either by PCI or CABG. In the Syntax trial, patients were divided into 3 tertiles depending on their score; low score (0-22), intermediate score (23-32) and high score (≥ 33)[2]. Final 5-year results showed that no significant difference in outcomes between PCI and CABG in low score patients. Significant difference was noted in MACCE (Major Adverse Cardiac Events) intermediate and high risk groups with no significant mortality difference in intermediate group[5]

Syntax score can also predict clinical outcomes in patients undergoing PCI and that the score is an independent risk factor for MACCE .This has been shown in different studies [6][7][8][9]

Limitations

Though the Syntax score has been validated by many studies , it still has some limitations.

It is a mere angiographic assessment method and does not incorporate other clinical factors which have been shown also to affect outcomes e.g. age , ejection fraction and creatinine clearance. One score which incorporates such parameters together with SX score and has shown better prognostic value is the clinical Syntax score[10].

Another limitation is visual assessment which is the basis for lesion severity assessment with potential intra-observer and inter-observer variability [11]. Potential solution is the use of QCA (Quantitative coronary Angiography) for determination of lesion severity[12]. Use of FFR (Fractional Flow Reserve) can also address this issue and the

functional Sx score which incorporates FFR with visual SX score have shown better risk stratification for patients undergoing PCI[13].

Key Points

- The Syntax score is an angiographic grading tool for complexity of coronary artery disease.
- It is based on other classification and scores and expert opinion.
- It is powerful prognostic tool to predict outcomes in patients with multivessel disease undergoing revascularization.

SYNTAX SCORE AlGORITHM

Q 1: Dominance. Each segment is weighed according to dominance and hence contribution to LV supply.

Q 2: Number of lesions.Multiple lesions < 3 vessel reference diameters apart are scored as one lesion. Lesions >3 vessel reference diameters are considered as separate lesions

Q 3 : Segments involved per lesion. The 16 segment coronary tree adopted by AHA is used.

Q 4: Total occlusion. If No, 2 pionts are given for non-occlusive disease. If yes, 5 points are given. Additional 1 point is given forage > 3 months, blunt stump, bridging collaterals, SB < 1.5 mm.

Q 5: Trifurcation. If yes then number of segments involved. For 1,2,3 and 4 segments, +3, +4, +5,and + 6 points are given respectively.

Q 6: Bifurcation. If yes, 1 point is given for type A(1,0,0) , B(0,1,0), C (1,1,0).Two points for D (1,1,1) , E (0,0,1), F(1,0,1) , and G (0,1,1,). An angle < 70° is given 1 point.

Q 7: Aorto-ostial disease. If yes, one point is given

Q 8: Severe tortuosity. If yes , +2 points.

Q 9: Length > 20 mm. If yes, + 1 point

Q 10: Heavy calcification.If yes, + 2 points.

Q 11: Thrombus. If yes, + 1 point.

Q 12: Diffuse disease. If yes , + 1 point for each segment.

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