Cost-Effectiveness of PET-CT Versus Adrenal Vein Sampling for the Diagnosis of Hypertension Caused by Primary Aldosteronism

PMD74

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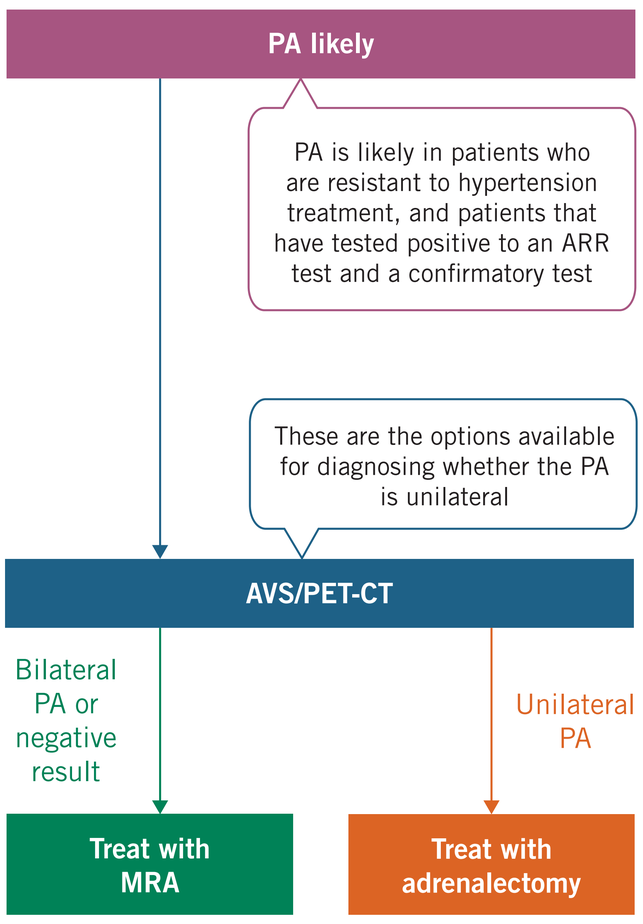
Objective

- The aim was to compare the cost-effectiveness of PET-CT versus AVS for the identification of PA patients suitable for surgery.

Background

- Primary aldosteronism (PA) is caused by a benign adrenal gland tumour and leads to the development of hypertension (high blood pressure). PA is the cause of 11% of all hypertension cases.[1]
- If unilateral, PA can be cured by surgical removal of the affected gland, but it is not always diagnosed as the current technique for diagnosing unilateral PA (adrenal vein sampling [AVS]) has a high failure rate and is unpleasant for patients.
- Positron emission tomography-computed tomography (PET-CT) with ^{11}C-metomidate as the radiotracer is a potential alternative diagnosis method, which is less invasive and easier to conduct than AVS.
- **Figure 1** shows the diagnosis process and where AVS and PET-CT can be used.

Figure 1 | Diagnosis process of PA

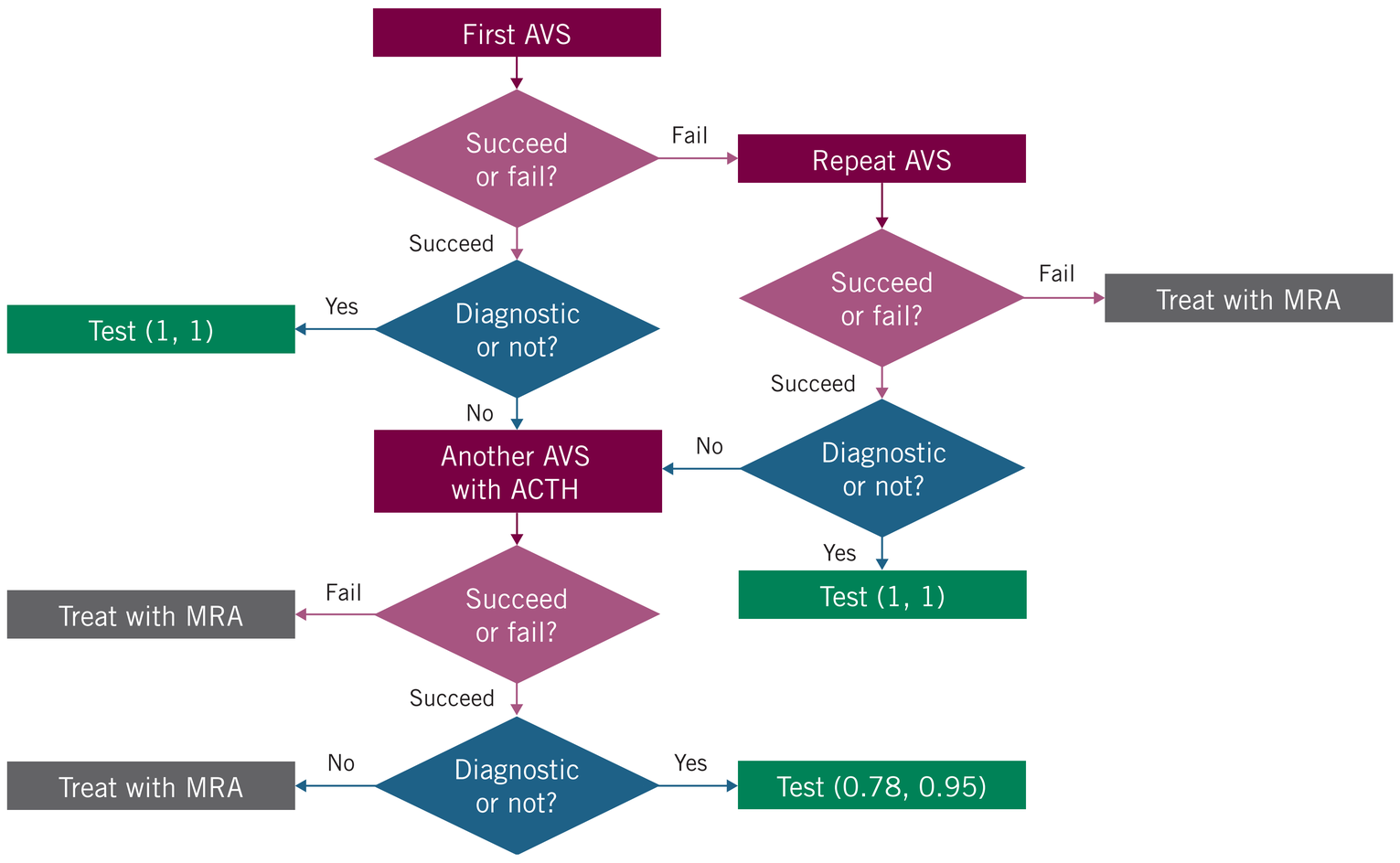


ARR: aldosterone-renin ratio; AVS: adrenal vein sampling; MRA: mineralocorticoid receptor antagonist; PA: primary aldosteronism; PET-CT: positron emission tomography-computed tomography.

Methods

- A decision tree was used to model the diagnostic outcomes of using AVS or PET-CT, and then patients were fed into a discrete event simulation that modelled the outcomes of surgery and the subsequent risk of cardiovascular events. **Figure 2** shows the decision process for AVS. There is no equivalent figure for PET-CT as multiple procedures are not required.

Figure 2 | AVS process



ACTH: adrenocorticotropic hormone; AVS: adrenal vein sampling; MRA: mineralocorticoid receptor antagonist; Test (Sensitivity, Specificity).
Inputs were derived from the literature[2,3] and clinical expert opinion.

- Anonymised individual patient data from Addenbrooke's hospital (Cambridge, United Kingdom [UK]) were used to inform the patient characteristics of those screened, which included age, sex, systolic and diastolic blood pressure, the aldosterone-renin ratio, and the entry aldosterone producing adenoma status. Sensitivity and specificity of the diagnostics were taken from the literature.[3–6]
- The model captured the impact of hypertension on the risk of cardiovascular events and death using the Framingham risk equations.[7]
- The model used a UK National Health Service (NHS) perspective, a lifetime time horizon and a 3.5% annual discount rate. Key cost inputs are shown in **Table 1**. Baseline utilities were sourced from the literature[8] and the event utility weights **(Table 2)** were used to obtain the utility values used in the model.

Table 2 | Event utility weights

Health state	Utility weight	Source
MI (first 6 months)	0.76	NICE Clinical Guidance[12]
Post MI	0.88	
Unstable angina (first 6 months)	0.77	
Stroke	0.63	
Diabetes	0.90	
Heart failure	0.71	
Death	0	
Post unstable angina	0.80	Assumption
No event	1	

MI: myocardial infarction; NICE: National Institute for Health and Care Excellence.

Table 1 | Key cost inputs

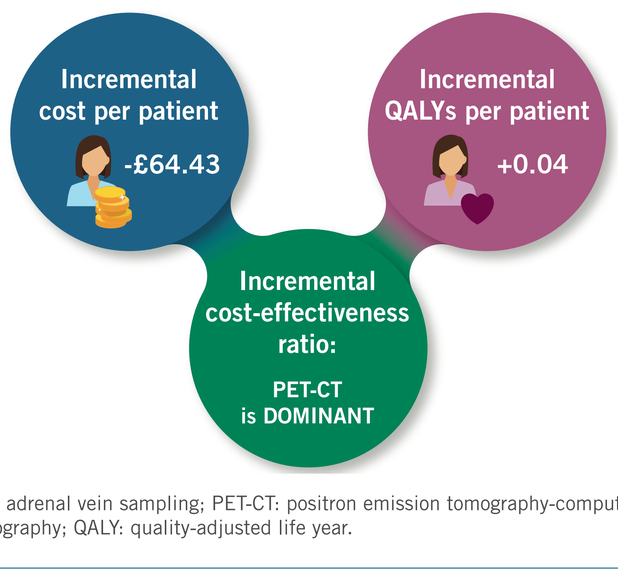
Cost variables	Value	Source
Cost of CT scan	£93.03	NHS Reference Costs 2014–15[9]
Cost of surgery (open, 3–4 days)	£5,335.82	
Cost of surgery (laparoscopic, 2–3 days)	£3,000.00	Clinician validation
Cost of ARR test	£50.00	
Cost of confirmatory test	£150.00	
Cost of PET-CT scan	£1,000.00	
Cost of AVS	£1,200.00	Clinician validation and PSSRU Unit Costs of Health & Social Care[10]
Annual cost of standard hypertension drugs	£34.05	eMit weighted average[11]
Annual cost of hypertension drugs for improved patients	£16.87	
Annual cost of anti-aldosterone drugs	£55.75	

ARR: aldosterone-renin ratio; AVS: adrenal vein sampling; CT: computerised tomography; eMit: electronic market information tool; NHS: National Health Service; PET-CT: positron emission tomography-computed tomography; PSSRU: Personal Social Services Research Unit.

Results

- PET-CT resulted in 0.04 additional quality-adjusted life years (QALYs) (11.340 vs 11.299 for PET-CT vs AVS, respectively) and £64.43 lower costs (£8,571.93 vs £8,636.36 for PET-CT vs AVS, respectively), meaning that PET-CT dominated AVS **(Figure 3)**.
- PET-CT remained dominant across the majority of one-way sensitivity analyses, with positive incremental cost-effectiveness ratios (ICERs) under £10,000/QALY only for the upper bound of PET-CT cost (£6,997/QALY), upper bound of cost of laparoscopic adrenalectomy (£246/QALY) and lower bound of AVS cost (£7,702/QALY).

Figure 3 | Results – PET-CT vs AVS



AVS: adrenal vein sampling; PET-CT: positron emission tomography-computed tomography; QALY: quality-adjusted life year.

Conclusions

- Overall, PET-CT was a cost-saving alternative to AVS for the diagnosis of unilateral PA, due to the greater number of successful surgeries and hence better long-term outcomes.
- This could change the way that PA is diagnosed in clinical practice, providing a less traumatic method for patients.
- The main limitation of this model is that probabilistic sensitivity analysis could not be run due to computational time required, and therefore the uncertainty within the model could not be fully evaluated.

References

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