American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Routine Chest Radiographs in Uncomplicated Hypertension**

Variant 1: **Mild hypertension: diastolic pressure 90-104 mm Hg.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	1		Min
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 2: **Moderate or severe hypertension: diastolic pressure 105-114 mm Hg or ≥115 mm Hg.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	5		Min
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

ROUTINE CHEST RADIOGRAPHS IN UNCOMPLICATED HYPERTENSION

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Summary of Literature Review

Hypertension (HTN) is a worldwide epidemic and often called a silent killer. Fifty percent of the population older than 60 years has it. Overall approximately 20% of world's adults have HTN. It is estimated that about 50 million Americans have hypertension but about 30% do not know it.

According to the Joint National Committee on Hypertension [1], optimal blood pressure for adults is systolic <120 mm Hg and diastolic <80 mm Hg. The four supranormal levels of blood pressure are prehypertension (systolic 120-139 or diastolic 80-89); Stage I (systolic 140-159 or diastolic 90-99); Stage II (systolic ≥160 or diastolic ≥100); and Stage III (systolic ≥180 or diastolic ≥110). HTN may be either essential or secondary. Essential HTN is diagnosed in the absence of an identifiable secondary cause. Approximately 95% of American adults have essential HTN, while secondary HTN accounts for fewer than 5% cases. Uncomplicated HTN has no cardiorespiratory symptoms (pain or dyspnea) or signs of complications such as congestive heart failure (CHF), stroke, or transient ischemic attack (TIA).

The major complications of HTN are coronary heart disease, CHF, stroke, atrial fibrillation, and TIA. The assessment of target organ damage is important in evaluating of a hypertensive patient as it provides an indication of the severity of HTN. The usual markers of target organ damage are fundal changes, renal function, and left ventricular hypertrophy. Medical treatment of HTN has been shown to reduce the incidence of complications and mortality [2-4].

Several noninvasive tests are used for evaluating of hypertensive patients, including conventional electrocardiogram (ECG), chest radiography, and echocardiography. In practice, the ECG seems to be routinely performed as part of the initial and follow-up examination.

There is disagreement regarding the usefulness of the routine chest radiograph in patients with uncomplicated HTN. Hypertensive guidelines do not recommend the chest radiograph in the routine evaluation of uncomplicated HTN, probably because cardiothoracic ratio has been considered as an unreliable investigation in the assessment of left ventricular hypertrophy (LVH) in hypertensive patients. A routine chest radiograph obtained in the hypertensive patient evaluation has been advocated to: 1) screen for unsuspected abnormalities of the lungs and thorax; 2) assess for cardiomegaly; 3) serve as a baseline for future measurement; and 4) assist in patient management. Frohlich [3] proposed that "a routine chest radiograph is worthwhile in the patient with HTN. It permits recognition of LVH, the stigmata of coarctation, complications of hypertension (pulmonary congestion, aortic enlargement) and provides some prognostic implications about the disease." Others have used initial (pretreatment) chest radiographs in HTN patients to measure heart size. Follow-up comparative chest radiographs obtained after medical treatment were used to assess reversal, stability, or progression of the cardiomegaly and LVH [2]. Although radiographic cardiomegaly does not necessarily indicate impaired left ventricular function [5], a diagnosis of cardiomegaly does seem to have some prognostic value [2,4,6].

Cardiomegaly by chest radiograph was shown to be the best predictor for the eventual development of CHF [4], and it is associated with increased mortality compared with cases without cardiomegaly [7]. Hartford et al [8] reported that cardiomegaly was found in 17% of patients with moderate to severe HTN, compared with 7% of patients with mild HTN. Sokolow and Perloff [6] reported that patients with radiographic cardiomegaly have a worse prognosis at any level of blood pressure elevation than those without radiographic cardiomegaly. Cardiomegaly may also be used by cardiologists as an indication to perform additional testing (especially echocardiography). According to Rayner et al [9], chest radiograph provides important predictive information of associated target organ damage in hypertensive patients. In their study, cardiothoracic ratio and dilatation of ascending aorta were useful in predicting LVH and other markers of target organ damage.

However, none of these studies show that the chest radiographic findings directly influence treatment decisions; the patient will still be treated to achieve lower blood pressure regardless of the radiographic findings.

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Some authors conclude that routine chest radiographs in patients with uncomplicated HTN are of little or no value [10,11]. Thoracic abnormalities found on routine chest radiographs were usually minor (eg, old granulomatous disease, calcified or tortuous aorta, pleural thickening, etc). These findings were not useful for treatment decisions or for prognosis [12]. Cardiomegaly on chest radiography does not necessarily indicate impaired left ventricular function [5]. Chest radiography has been shown to have poor sensitivity and specificity for detecting LVH, especially when compared with echocardiography in adults [10,13]. One study, based on autopsy findings, found chest radiographs to be of limited value; they showed cardiac enlargement in only 7% of patients with autopsy-proven LVH [12]. In this study, echocardiographic examination was found to be the most sensitive, specific, and accurate method of detecting LVH.

Summary

The diagnosis of LVH is important because it identifies patients at risk for developing complications. However, the chest radiography is insensitive for detecting of LVH, and LVH is best detected by echocardiography. It is not clear from the available studies whether the detection of cardiomegaly in hypertensive patients by chest radiography is useful enough to warrant its routine use. Routine chest radiography does not seem to be clearly indicated in uncomplicated HTN. It should probably be reserved for patients with cardiorespiratory symptoms or signs on physical examination or patients with suspected coarctation of the aorta, and possibly in the evaluation of patients with moderate to severe HTN.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document.

Relative Radiation Level Designations	
Relative Radiation Level	**Effective Dose Estimate Range**
None	0
Minimal	< 0.1 mSv
Low	0.1-1 mSv
Medium	1-10 mSv
High	10-100 mSv

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