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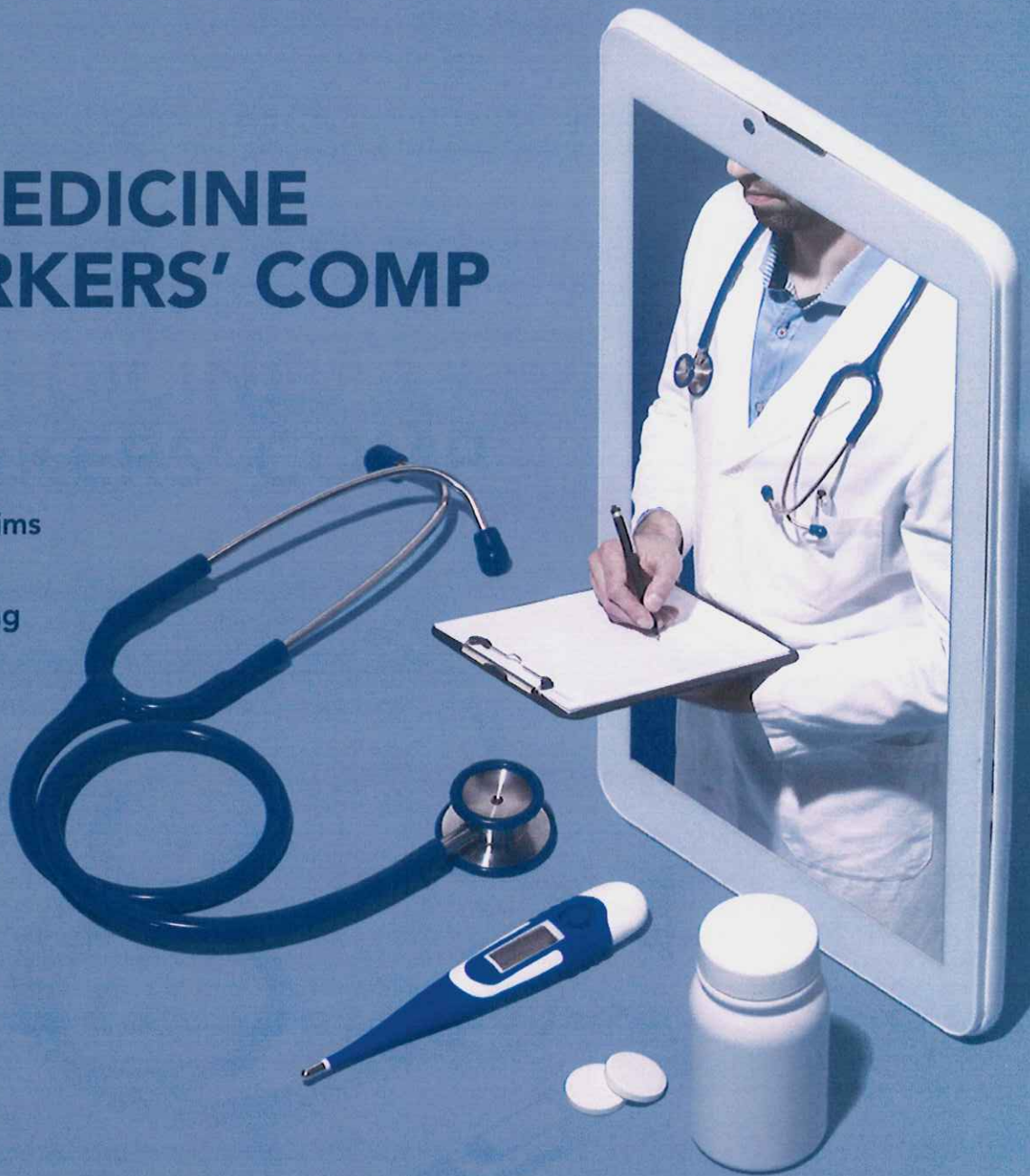
D&O legal trends
p. 22

Post-COVID-19 claims
p. 25

Remote onboarding
new hires
p. 28

Food poisoning
claims
p. 31

Avoiding bad faith
p. 33



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Figure 1



Figure 2

Down Goes the Tractor

By Charles C. Roberts, Jr., Ph.D., P.E.

ACCORDING TO THE UNITED States Department of Labor, 44% of farm accidents are due to tractor rollovers. The National Agricultural Tractor Safety Initiative reports that tractors cause about 130 deaths annually — or half of all farm-worker fatalities. This case study deals with a common type of tractor upset where the tractor ends up upside down. Figure 1 shows the tractor at the accident scene. The tractor was being operated for

pulling down a tree with a chain attached to the tractor body and the base of a tree. While performing this task, the tractor turned over, ejected the driver and caught fire, resulting in a fatality.

Figure 2 is a close-up of the tractor showing burned areas as a result of volatile liquids, such as oil or gasoline, contacting hot exhaust components after being expelled as a result of the tip-over.

Figure 3 shows the chain attached to

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the tree that was being removed. Figure 4 shows the location on the tractor where the chain was attached. The attachment was high above the rear axle near the driver's seat at a three-point hitch upper fitting.

Figure 5 depicts the probable scenario regarding this accident. The chain is attached to a point high above the rear axle of the tractor as shown in Figure 5A. As the tractor pulls on the chain where the resistance is high, the front of the tractor can "rear up" as shown in Figure 5B. Since farm tractors have a very low first gear, there is sufficient torque available to actually lift the front of the tractor and tip over toward the rear when the resistance to pull is very high, as in this case. This tractor had a fixed throttle, so it continued to operate, despite the operator falling off the vehicle.

Figure 6 shows the proper way to apply a pull load to a tractor. The hitch is below the axle which applies a torque that keeps the tractor front on the ground. If the load is excessive, the rear wheels merely spin without turning over the tractor. A roll-over protective structure (R.O.P.S.) may have helped in this case but was not standard equipment on older tractors. Most modern small farm tractors are equipped with a roll-over protective structure. The root cause of the accident was improper usage of a farm tractor.

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Figure 3



Figure 4

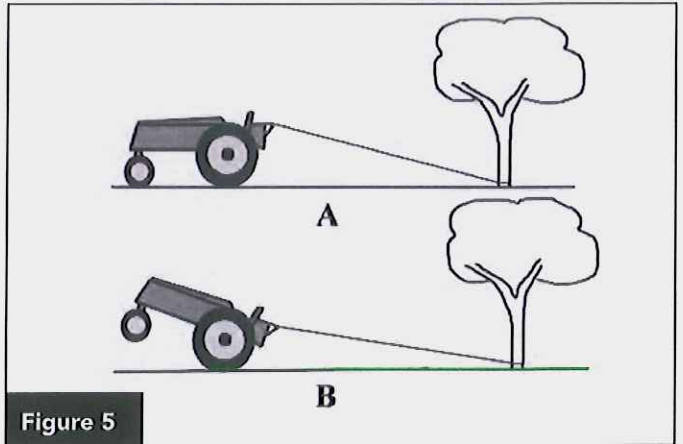


Figure 5

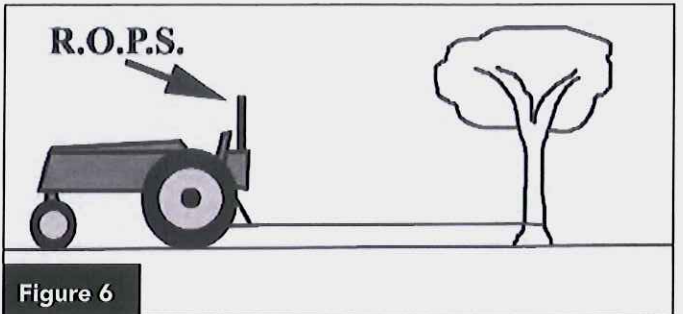


Figure 6